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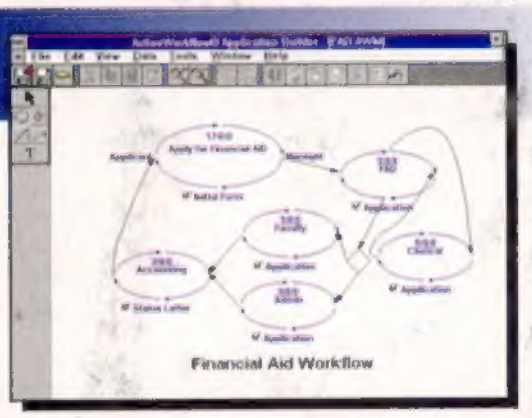

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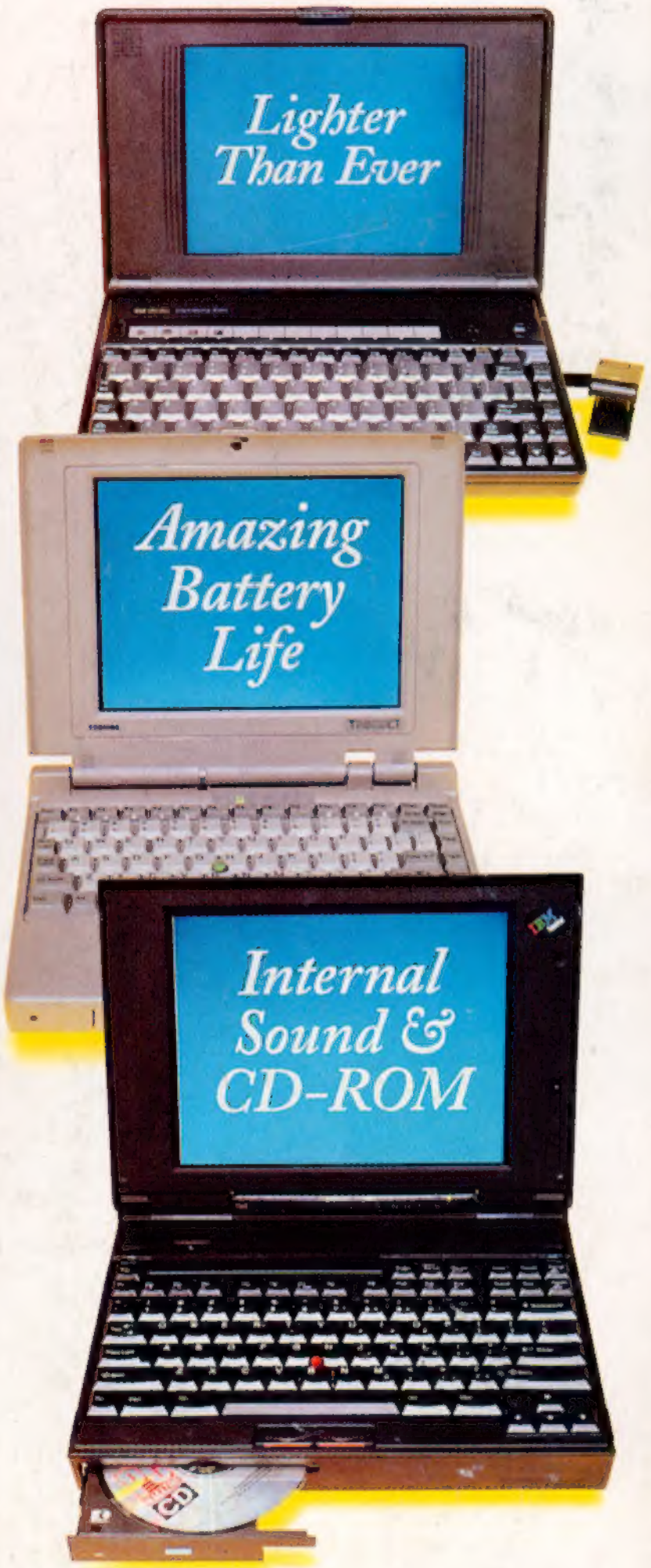
Portable POWER

Can they Replace Your Desktop PC?



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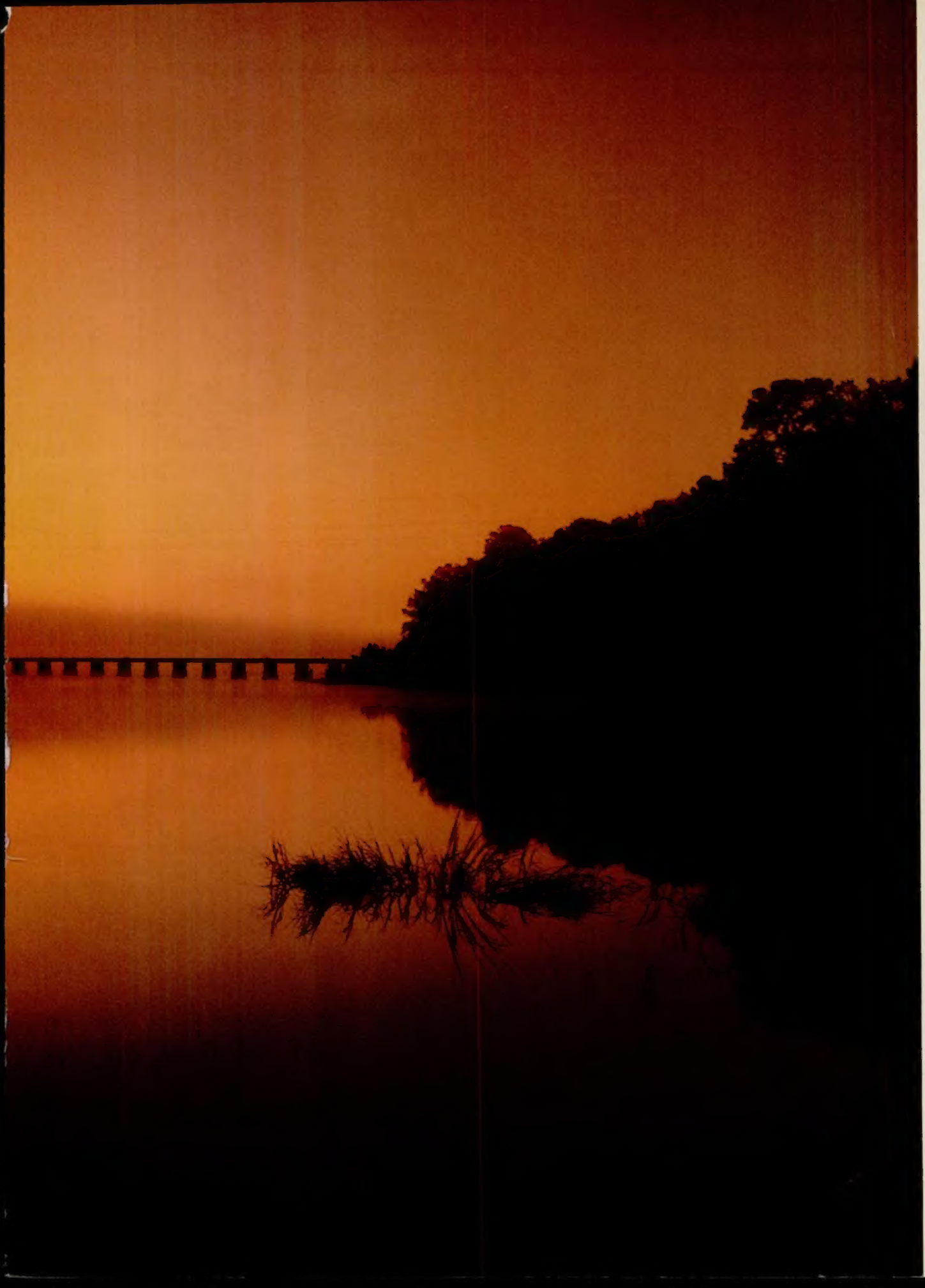

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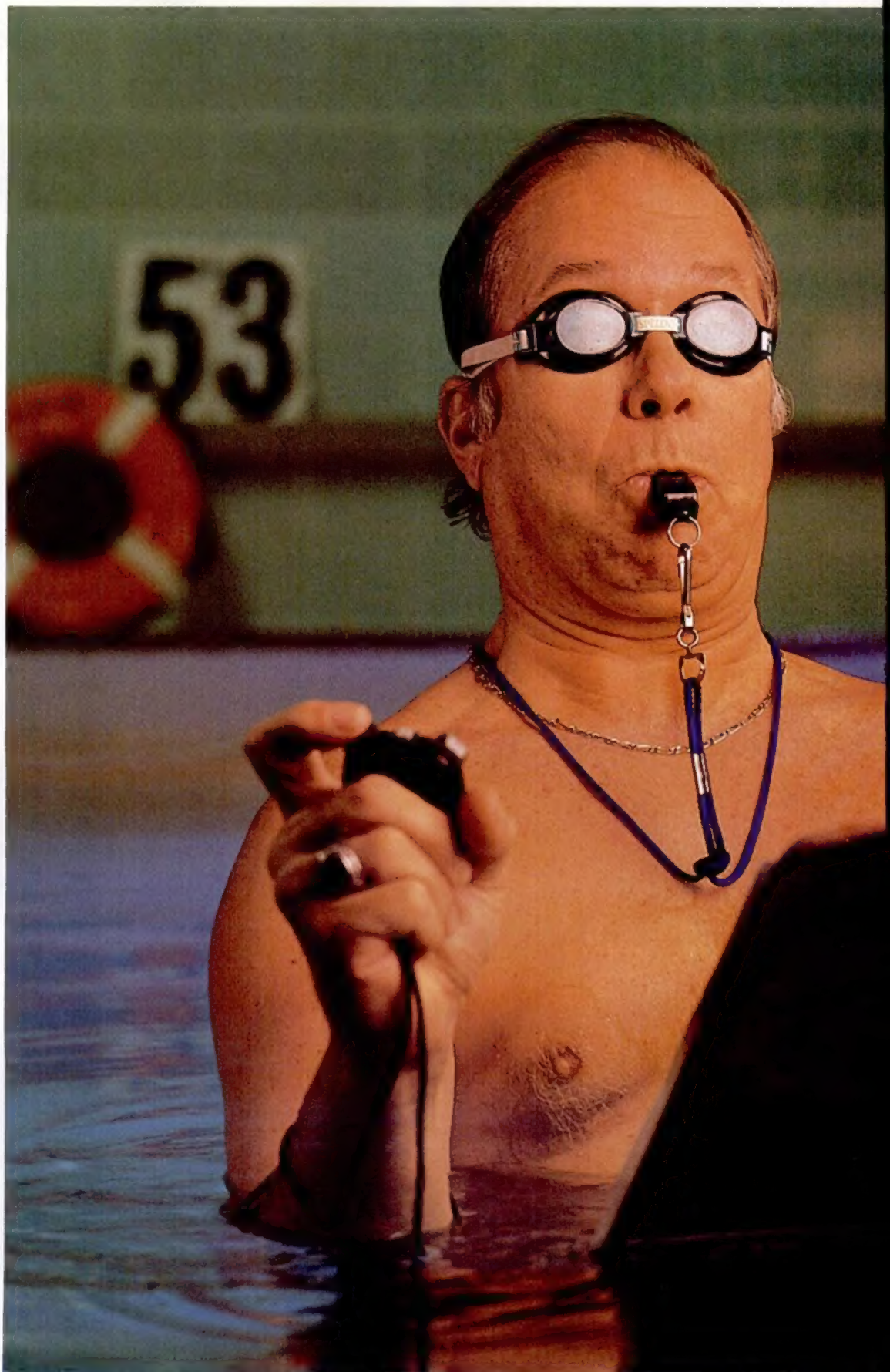

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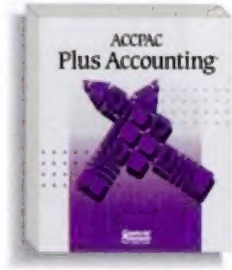

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Inside

No single slice of the PC market has changed quite as fast as portable computers. It seems as if every time we turn around, we see a new set of machines with capabilities that go beyond those of the previous generation.

This became extremely evident as we tested color notebook computers for this issue. We last looked at portables in the summer. The biggest change since then: "There are fewer compromises in these machines," says associate editor John Clyman. "Virtually everything you'd want in a fully loaded desktop is now available in a notebook."

PC Magazine Labs' rigorous battery life tests put notebooks through their paces.

Clyman was also impressed by the growth and diversity of this market. We found no fewer than 68 new products to test. The machines range from tiny ones that still pack considerable power, such as the Toshiba Portégé T3600CT and the HP OmniBook 600C, to machines that really meet the specifications of their desktop equivalents. Among the tested units, 3—the Panasonic V41, the IBM Thinkpad 755CD, and the MPC CD-Book—even have internal CD-ROM drives. All but 1 of the machines have built-in mice or other pointing devices; more than 40 have built-in sound capabilities.

One of the toughest things to test is battery life, a crucial element for most laptop buyers. Project leader Rich Fisco and his team of technicians at PC Magazine Labs spent weeks putting the machines through their paces. We tested all the machines using WinDrain, which simulates a heavy-usage battery rundown. For certain machines, we supplemented WinDrain with ZDigit, another automated battery rundown test that types on the keyboard at periodic intervals, more realistically portraying real-world keyboard usage. The results will surprise you: One of the smallest machines actually had the best battery life of all. By the summer issue, we hope to unveil a whole new generation of battery tests.

Of course, by summer we also expect to look at a whole new generation of notebooks.

—Michael J. Miller

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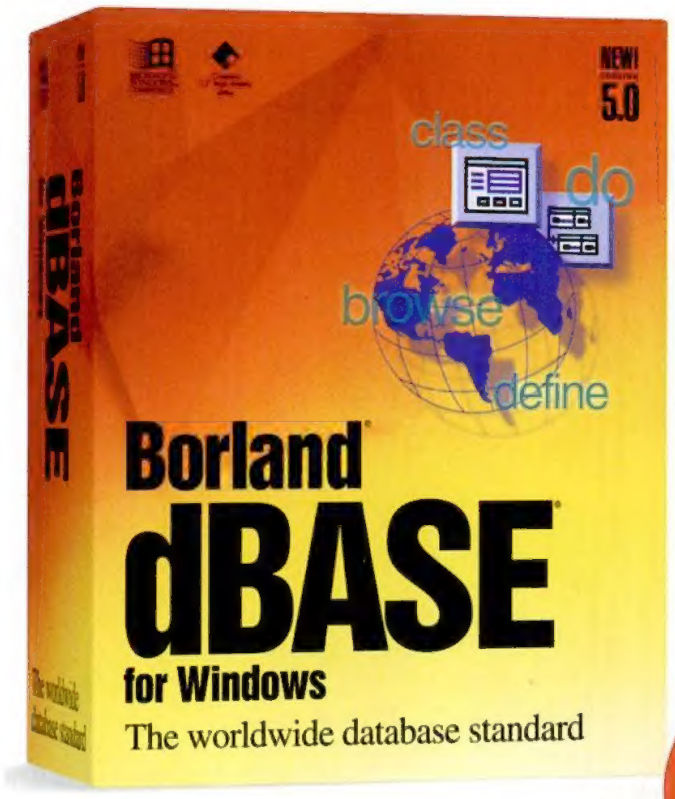

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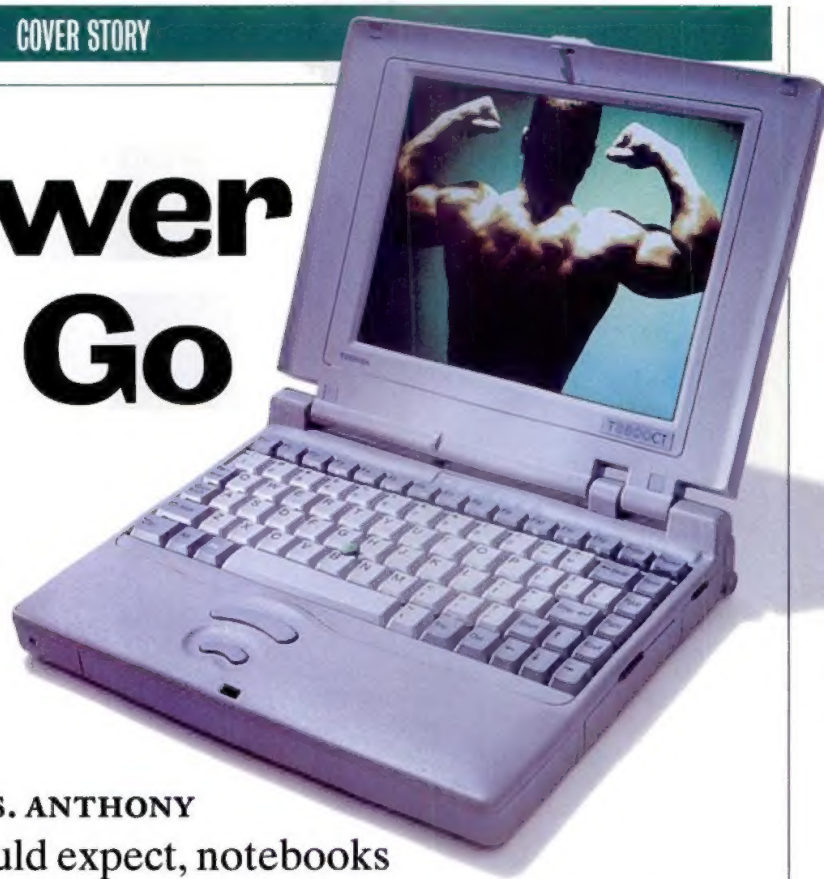

BY ROBERT S. ANTHONY

As you would expect, notebooks are lighter and faster and last longer than ever before. Bright color screens are standard, and even 16-bit sound is becoming mainstream. What you might not expect is Pentium notebooks—and notebooks with built-in CD-ROM drives at travel weights under 10 pounds (and sometimes even under 9). We test 68 color notebooks and subnotebooks **108**

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Photo Illustration: Image Is Everything

BY LANCE ULANOFF AND JEFF MACE As image-editing packages have expanded to include paint features and paint packages have grown to include image-editing features, the two categories have merged into one area: photo illustration. We review six Windows-based photo-illustration packages, testing the ability of each to handle both painting and image-editing tasks. Some products can manage a variety of tasks, but others remain strong in either image editing or painting. Our reviews lead you in the right direction for your needs.....**183**

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Networking

PCMCIA Connectivity: Socket to Us

BY STEVE RIGNEY PCMCIA products are finally maturing. Favored from their introduction because they were the perfect complement to the explosively popular new notebooks and subnotebooks, they have also been maligned because of hardware and software compatibility problems. With the introduction of a new standard, many problems have been addressed—even the bothersome acronym. Over the past year, the products have become more reliable and easier to use. They are worth the premium you pay in dollars, RAM, and battery life to use them. And within each line of cards, performance approaches, matches, or even surpasses that of standard-size adapters. Here is the latest take on PCMCIA technology—especially the Card Services and Socket Services software. We test representative PCMCIA modems and LAN adapters and take a quick look at some other PCMCIA cards, including sound cards, video capture cards, and even one that connects to the satellite-based Global Positioning System.....**207**

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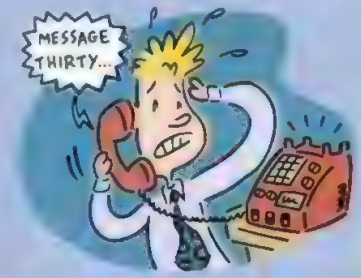

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WordPerfect and Novell have united to create the perfect office.

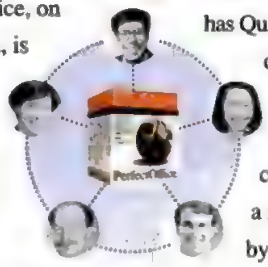
Makes Microsoft Offi

Introducing PerfectOffice.™
The first network suite.
Unlike Microsoft Office, it doesn't box you in. So you can work with other people and other information. Any time and place you want. It isn't just another office, it's the perfect place to work.™

NEW PERFECTOFFICE FOR WINDOWS

The network suite vs. the stand-alone suite.

You don't work alone. Why should your software? PerfectOffice is the first suite designed to work with your network. So you can communicate, collaborate and cooperate with other people. It even makes installing, maintaining and managing software easier. Microsoft Office, on the other hand, is designed to work on your desktop. Alone.



Complete integration vs. partial integration.

The programs in PerfectOffice have a consistent interface. So do the programs in Microsoft Office. But PerfectOffice uses more common code and components, reducing system requirements. Plus, it supports Windows technologies like OLE 2.0 in more programs than Microsoft Office. Ironic, isn't it?

Automatic software vs. manual software.

Only PerfectOffice has QuickTasks™ that do your work for you. So you can do things like create and E-mail a memo simply by clicking a button. PerfectOffice is so automatic, it even corrects spelling errors as you type. We know, so does Microsoft

	PerfectOffice 3.0 Standard Edition	Microsoft Office 4.2 Standard Edition
Programs have consistent interfaces	YES	YES
Integrated E-mail, calendaring and scheduling**	YES	NO
Workgroup publishing features	YES	NO
Number of applications with OLE 2.0 support	Four	Three
Number of applications with on-the-fly spell checking	Three	One
Automated tasks that work independent of applications	YES	NO
Grammar checker can rewrite entire sentences	YES	NO
Intelligent find and replace	YES	NO
Ability to record scripts (macros) across applications	YES	NO
Supports both Visual Basic & AppWare programming tools	YES	NO
Six months of free, toll-free technical support*	YES	NO

WordPerfect 6.1
The world's best-selling word processor, with intelligent new features that make you a better writer.

Quattro Pro 6.0
The easiest-to-use spreadsheet, creating more types of charts and graphs than any other.

Presentations 3.0
The innovative program that helps you create more effective presentations.

InfoCentral 1.1
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PerfectOffice™

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IF PATIENCE IS A VIRTUE, THEN WE MUST BE GOING TO HELL.

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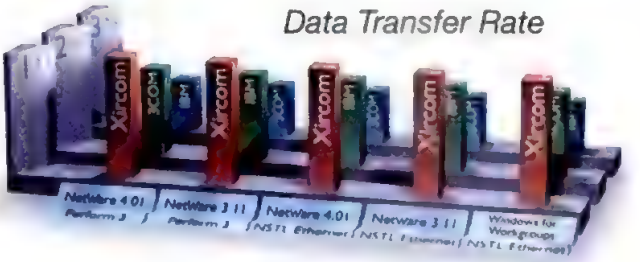
All thanks to our advanced, Look-Ahead Pipelining and unique full duplex capability. Which increases the raw data rate of the network. More importantly however, this allows you to send and receive messages at the same time.

All this amounts to one thing: Pure speed. Pure, unprecedented, pressed-back-in-your-office-chair kind of speed which not only makes your applications scream, but your colleagues whisper.

But the temptations don't end there. Xircom also offers you a new Performance Series Token-Ring CreditCard. And every Performance Series product is guaranteed to be compatible with every make and type of notebook. Additionally, they come with the widest range of NOS support available. Along with unmatched ease of use — as an example, our new Windows-based installation program gets you up and running in under one minute.

For a complete copy of our third-party test results, just call us at 1-800-775-0400 and request document #7001. Or if you'd like to receive our performance white paper, simply request document #7002.



Check out the facts. You will surely find that what comes standard from Xircom makes our new, faster LAN adapters anything but standard.

CHECKLIST	Xircom	Others
Full Duplex Support	YES	NO
Advanced Power Management	YES	NO
Suspend/Resume Support	YES	NO
DOS, Windows, OS/2, NT & Unix Support	YES	?
Network Operating System Support	8	?
	70+	?

With all this, it's no wonder that Xircom has connected over two times as many notebooks to LANs as all other LAN adapter vendors combined. In fact, there are already over a million satisfied Xircom LAN adapter users throughout the world.

Our rigid quality control along with our comprehensive spectrum of tests ensure that every Xircom LAN adapter will stand up to the heat of the real world. Which is why we are able to back all of our products with a lifetime warranty.

At least for this lifetime.

What's more, every Xircom LAN adapter is backed by superior technical support. And a lifetime upgrade policy that lets impatient users get the latest technology at a substantial discount. We even offer 24-hour BBS and online CompuServe support.

So, if you are tired of waiting on your slower LAN adapter, visit or call your Xircom dealer or VAR.

Or you can call Xircom directly at 1-800-438-4526, Ext. 35B. We'll send you more detailed information about our new, impressively fast Performance Series CreditCard.

And then you can connect to your LAN with the one CreditCard that will never try your patience.

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October 1994
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Windows Sources EXPERTS' PICK
August 1994
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September 27,1994
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NOKIA MONITORS

Letters

IT'S TIME TO MAKE THE CONNECTION

Thanks for a great article on the Internet ("Making the Internet Connection," October 11, 1994). Getting a connection set up and working properly is generally a pain for most people, but once users realize the wealth of information available on every subject imaginable, I think they'll agree that it's worth the effort. Also, thanks from us veteran Internet users for your list of good Web and FTP sites. Stories such as this one are what keep you positioned as the best computing magazine around.

Daniel C. Armstrong
via the Internet

Such a wealth of information makes the Internet worth the hassles.

It's disappointing to find you ignored the free-nets. The free-nets have been started in many communities both here and abroad, offering Internet connections at little or no charge. Depending on your location, membership can give you access to as much as 80 percent or more of the Internet's resources.

Richard Boehringer
via PC MagNet

It's inconceivable to suggest PC users spend $300 to $500 for a package of "tools" whose useful worth is dubious at best. I'm sure I'm not the only would-be newbie who decided to wait a while if it was going to cost $500 for an Internet access package. The "Infobahn" has much smaller toll booths available to those who look for them.

C. Brent Herridge
via the Internet

Your Internet story was very well done, especially the part explaining how the connections work in as much detail as any normal sort of person might ever want or need to know. I plan to save this issue and pass it along when friends and colleagues ask me to explain the mysteries of the Internet.

Donne Florence
via the Internet

There are on-line service and Internet access providers who do not charge a service fee, per-hour connect charge, or e-mail surcharges—which makes sense: Why would I, or any intelligent user, pay for something that is and should be free to begin with?

Kelly Wink
via the Internet

The section examining "How to Search the Internet" could have been dramatically improved by providing instructions on how to perform the comparable searches from the command line. This would have been beneficial for those of us newbies who are not yet using a graphical interface for the Internet. When I first received an Internet account, I had logged on 15 times before I figured out that "man" was Unix for "help."

John Elftmann
via PC MagNet

I'm fed up drooling over articles heralding the ease with which on-line access allows you to connect with the outside world. Poppycock! That's only the case if you're lucky enough to live within the local calling area of an on-line service's or Internet provider's access number. Ruralites like myself, however, can only look forward to outrageously high long-distance phone bills. I'd thoroughly enjoy exploring the Internet during long, dark, snowy Vermont evenings, but I like to eat, too!

Charlotte Chamitoff
Derby Line, Vermont

Congratulations on your superb Internet cover story. I just wish you would have run that story months ago, back when I was first trying to figure out how to get on the Internet. Your article would have helped tremendously at that time.

Michael Brazinskas
via PC MagNet

PC Magazine opened my eyes to another way of connecting to the Internet. As soon as I read this article, I logged onto my local service and downloaded its unofficial collection of SLIP software. Although I don't get full SLIP/PPP access, it's close enough. I was up and running in less than 30 minutes, with multiple sessions going at once. And armed with your amazing list of FTP sites, I'll be able to maximize my use of the Internet.

Kevin Eng
via the Internet

As a high school student, I share my peers' concern that not enough is being done to facilitate access to the Internet for students anxious to "get wired." The electronic information revolution must come to our schools, whether the government, the school boards, or a bake sale foots the bill. Steps have to be taken so today's students get the Internet access that's necessary for them to compete in the future.

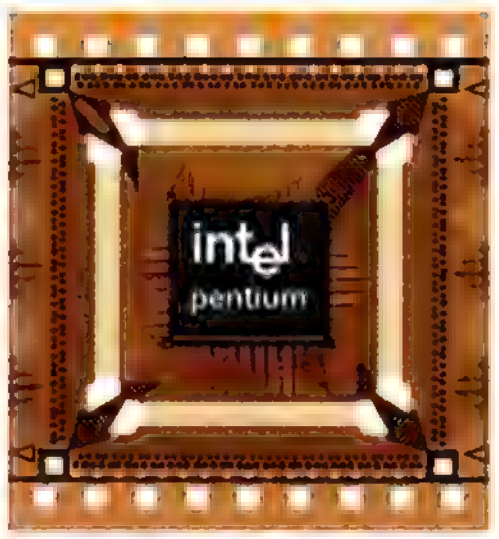
Justin Kominar
via the Internet

STOP BY OUR HUMBLE HOME

Having just visited the *PC Magazine* World-Wide Web site on the Internet, I must say it's great. I'm new to the Web, and I'm thrilled to have found this incredibly useful and informative site. This is just one more reason why *PC Magazine* is the best magazine for my money. Kudos to everyone at *PC Magazine* involved with the creation of this Web site.

Roger L. Smith
via the Internet

MOBILE PENTIUM.



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The 75MHz mobile Pentium™ processor from Intel, with state-of-the-art Tape Carrier Packaging (TCP), is designed specifically for notebooks. Toshiba's engineers have crafted the T4900CT using this processor, so there is no need for fans or special cooling systems. Then they've added advances

T4900CT FEATURES:

- 75MHz Intel Pentium,™ 3.3 volt processor, 16KB cache
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- 810 Million Byte (=772MB) HDD
- 8MB RAM expandable to 40MB
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- VL local-bus video
- Integrated graphics accelerator
- 65,536 (64K) simultaneous colors
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- Audio jacks: headphone/speakers and microphone
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- 6.9 lbs.
- 3.5" 1.44MB floppy disk drive
- Accupoint™ integrated pointing device
- Pre-installed software: DOS, Windows for Workgroups,® Windows Sound System,™ Run Time Video for Windows,™ Fn-esse™ software and Indeo™ video
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PORTABLE MAXIMUM.

Dock into the optional Desk Station IV for instant connection to your monitor, full-size keyboard, printer, and network. The T4900CT with Desk Station IV is all the computer you need.

The 10.4" color active matrix screen displays 65,536 (64K) simultaneous colors for stunningly realistic images and brilliant graphics.

10.4" dia.

Take all your files with you, including full-motion video and multimedia with the 810 million bytes (=772MB) hard disk drive.

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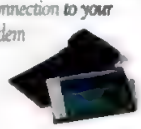
Dual PCMCIA expansion slots (Type II and Type III) run simultaneously—for connection to your LAN, fax/modem and more



like an AccuPoint™ integrated pointing device, 10.4" color active matrix display, and plug-and-play connection to peripherals. You can even blast MIDI and .WAV Audio through the built-in speaker or audio jacks for more dynamic multimedia presentations. See and hear this Pentium-powered touring machine today. **Call 1-800-457-7777 for the dealer nearest you.**

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CIRCLE 379 ON READER SERVICE CARD

LETTERS

• **You can access our Web page at the address *http://www.pcmag.ziff.com/~pcmag.* —*Ed.***

NOTHING IN LIFE IS FREE

In reading Bill Machrone's column "Needed: A Fee-Based Internet" (October 25, 1994), I became concerned that if the Internet goes to a fee-based system, someone will have to start controlling the Internet, which will in turn detract from its traditional appeal as a place where people can say, do, and present exactly what they want without fear of reprisal. If a fee can prevent this from happening, fine, as long as the money is put back into the Internet and not into someone's pocket.

Doug Perkerson
via the Internet

In spite of Machrone's comments, I cannot understand anyone being upset over flame mail. After all, words are just that—words. Perhaps Machrone should be reminded of the old saying about sticks and stones.

Ellis Glazier
via the Internet

One of the biggest problems for new users of the Internet is that it's simply too difficult to find and use all that the Internet has to offer. I for one would be willing to pay for a road map if such an option became available. As for flames—well, at least no one is going to do any physical damage to you over the Internet.

Steve Flowers
via PC MagNet

Providing services like the ones Machrone discusses is the role of commercial services, not the Internet itself. If those commercial services use the Internet to make a profit, then they should pay for its use. Otherwise, leave well enough alone.

William Harvey
via the Internet

It happens I have a tremendous respect for the Internet community. Note the word *community* here—not *customers.* I see no reason why a company can't put a server on-line and charge for logging on, but to mandate log-on charges for the entire Internet is ludicrous!

John Anest
via the Internet

If there's a need for what Machrone proposes, then let capitalism take its course and develop an Internet service without affecting the Internet we already have.

Chris Huryn
via the Internet

ONLY IN A MICROSOFT WORLD

In his column "When Microsoft Wins, Do We Lose?" (October 11, 1994), Jim Seymour speaks the truth. I was glad to read his refreshingly accurate account of Microsoft's business strategy. Microsoft aggressively creates, markets, and sells products, and it does so very well. As for the cynical world-domination theorists, they are obviously too heavily influenced by Oliver Stone. I guess conspiracy sells as well as software.

Rod Hughes
Grand Prairie, Texas

It would seem that Seymour has rejected the importance of market competition for the end user. Does he really believe that users would be long-term winners if they were to graze contentedly in a soporific, self-contained Microsoft Office idyll?

Jordan V. Hodgson
Herndon, Virginia

Seymour poses the question "Is this. . .ummm. . .so bad?" with respect to Microsoft's dominance in the suite market, to which I can only answer, "Ummm. . .yes, it is that bad." The PC industry has always depended on fierce competition to keep things moving. And those of us who prefer non-Microsoft products will have fewer and fewer places to turn.

Daniel Dvorkin
via the Internet

To say that Microsoft's software is the best in the industry and needs no competitors is to ignore what pushed Microsoft to the top in the first place. As history has shown again and again, progress comes to a standstill when a single company dominates any industry.

Thomas Peng
via the Internet

A FULLY EXPANDABLE SYSTEM

Although it was gratifying to see that the ZEOS Pantera 90 was the highest-performing PC in your roundup of Pentium and 486 systems ("For Love or Money," December 6, 1994), the review concluded that the Pantera 90 was "an Editors' Choice contender in every respect but one: It can accept a full-length expansion card only in its shared PCI/ISA slot."

We've redesigned the Pantera 90 to include a modified motherboard layout so that four of the eight expansion slots accept full-length cards. We also now offer on-board PCI local-bus SCSI and Ethernet options for the addition of those 32-bit features without using the expansion slots.

Rick Apple
Vice President, Marketing
ZEOS International Ltd.
Minneapolis, Minnesota

CORRECTIONS AND AMPLIFICATIONS

The correct toll-free technical-support number for Frye Computer Systems' The Frye Utilities for Networks ("Network Management: Who's Minding Your Network?", November 8, 1994) is 800-234-3793.

The on-site service policy was misstated in the PC Express review ("For Love or Money," December 6, 1994) and in the features table listings for the PC Express EXP66, the PC Express EXP100, and the PC Express EXP90. On-site service is included for four years.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments and suggestions. Please send correspondence to Letters, *PC Magazine,* One Park Ave., New York, NY 10016-5802. You can send electronic mail via the Internet at *157.9301@mcimail.com,* or you can upload it to PC MagNet (see page 12 for access information). You can also send e-mail to individual editors. Type GO PCMSTAFF on ZiffNet for a list of addresses. All letters become the property of *PC Magazine* and are subject to editing.

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CIRCLE 377 ON READER SERVICE CARD

THE (*color laser printer that's so hot, even the reviews are glowing*) COMPANY

Kyla Carlson, PC Computing

"The "first real color laser... The Xerox 4900's output is, in a word, dazzling."

"Xerox has certainly set some new color quality standards that **may** send **other** vendors back to the **drawing board.**"

Marco Boer, International Data Corporation

THE DOCUMENT COMPANY

XEROX

Bill Gott, Printer Channel Monitor

"...brilliant color quality that will be hard for competitors to beat."

"The 4900 is fast and the print quality is equally impressive."

Frank Hertz, VARBusiness

"Through its resellers, Xerox will be able to communicate its big company commitment to customer satisfaction. That is a highly credible story, a story office system administrators will want to hear."

Michael Zeis, Color Business Report

"Quad dot enables Xerox to convey more real data in an image using the same number of pixels as other approaches. In the 4900, the combination of laser modulation and quad dot halftoning result in much higher quality halftones & very fine resolution."

Charles LeCompte, The Hard Copy Observer

Charles A. Pesko Ventures, Inc.

"There is currently no better combination of color and black and white laser printing in a single system. Xerox has delivered a powerful product..."

The news is out. The Xerox 4900 Color Laser Printer is so hot no other printer can touch it. Not that everyone else hasn't tried. They found ... as you will too ... our benchmark Quad Dot color imaging technology is unbeatable. And this level of quality has never been more affordable. It's now available at any desktop near you ... the finest quality laser image (up to 1200 x 300 dpi) Total Satisfaction Guaranteed. of any workgroup printer in its class. Period. From speed (3ppm color/12ppm b&w) to ease of everything, the 4900 is one printer that can help everyone in your group do better work. And with the Xerox Total Satisfaction Guarantee, it's the one you can be sure of. Because we'll guarantee your satisfaction for three full years. Call us at 1-800-ASK-XEROX, Ext. WT315 for more information and some great samples hot off the printer.

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CIRCLE 906 ON READER SERVICE CARD

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Two Type-III PCMCIA slots*
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Two Type-III PCMCIA slots*

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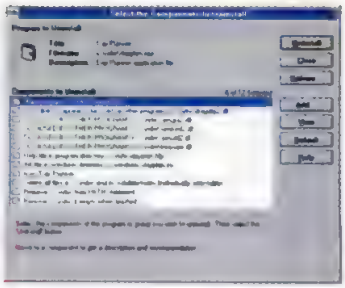
Megabytes More Storage!



What a mess! Windows programs leave fragments in every corner of your system. So, even after you've attempted to remove them, you end up running low on hard disk space.

Trying to free up space without knowing where every component is concealed can cost you valuable time...with no guarantee that useless fragments haven't slipped through the cracks. Until now!

With amazing new **CleanSweep**,™ you'll have spotlessly clean Windows. ***Reclaim megabytes of storage*** for dramatically **more hard disk space** and **better system performance!**

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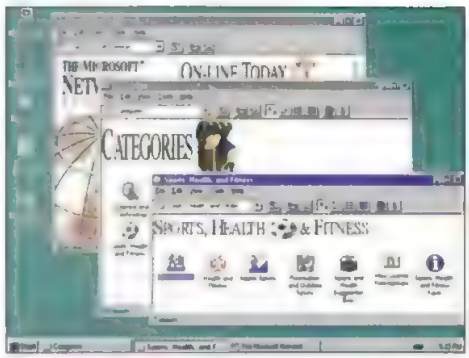
Marvel-ous Temptations

Microsoft courts electronic publishers.

Whether it's creating a hardware standard like Plug and Play, getting staid financial institutions to pay attention to on-line finance, or getting developers to buy into "tough" efforts like OLE, Bill Gates and company have a distinct knack for making folks listen up.



Microsoft has built easy access to The Microsoft Network into Windows 95.

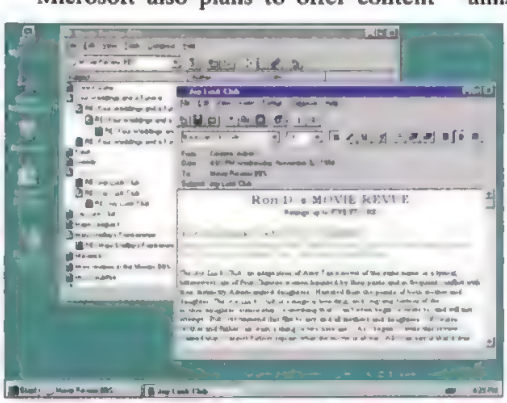
The next territory is the on-line world. It seems that Gates is already crafting a combination of "spin doctoring," vision, and perhaps a bit of strong-arming bound to make electronic publishers, or content providers, reconsider any on-line plans they've already made.

"Clearly, there's something missing from on-line services today. They're not exciting enough, different enough, fast enough, or easy enough," says Gates. Since only 10 percent of the Microsoft Windows users with modems (and only 4 percent of households) subscribe to on-line services, Gates sees a huge untapped market for a service that does things differently. So he rewrote the on-line business model to make The Microsoft Network—Microsoft's recently announced on-line service known until now as Marvel—attractive for on-line publishers.

What unique incentives will the network offer electronic publishers? Consumers. Since The Microsoft Network will be easily accessible from Windows 95, content providers will tap into a potentially huge subscriber base paying a monthly access fee as low as $4 or $5. And a bigger cut. "A key aspect of what we're doing differently is to allow content and service providers to create businesses on-line and to control the revenue possibilities," says George Meng, product manager for The Microsoft Network. The big difference is to de-emphasize revenue from connect-time charges, which on-line services rely on today. "We've talked to a lot of potential partners out there who see very little opportunity with this model because it's not pricing for the content's value."

Instead, Microsoft is giving content providers flexibility in terms of how to make money, whether by charging subscription fees, offering on-line transactions, or selling advertising. An on-line magazine, for example, would be able to stick with the traditional magazine business model that draws on three revenue sources: advertising, subscriptions, and impulse buys at the newsstand.

Microsoft also plans to offer content providers the tools and infrastructure to create original electronic products that take advantage of the interactive format and prominently display their brands. Microsoft is working now on a comprehensive design system that will incorporate Visual Basic and OLE. The goal is to allow people to use familiar tools like Microsoft Word or other word processors to create content.



Content will be provided by Microsoft at first, but other content providers may profit from the new on-line business model.

Initially, Microsoft will provide much of the content on the network, including tech-support forums, private forums, chat lines, and bulletin boards. Down the road, you can expect personal finance components on The Microsoft Network, says Meng. Part of the plan is to enable users to connect directly from their applications to the network for support. Clicking on an icon from the Excel toolbar, for example, will take you right to the Excel tech-support forum. Microsoft aims to make it easy for other developers to design this type of shortcut connection into their Windows applications.

While Microsoft has not yet announced any content providers, it demonstrated model services from *USA Today* and Nickelodeon at the launch in November.

How are the other on-line services reacting? Steve Case of America Online calls the network less than competitive. Debra Young of CompuServe says, "Microsoft will have excellent distribution via Windows 95 and can afford to operate at a loss to gain market share. The jury is still out on how quickly Microsoft can build meaningful content. We need to ensure that the playing ground is level and fair, and I think all three of the on-line services are going to work toward that." And Brian EK of Prodigy says, "We have been contacted by the Justice Department and will be talking with them."—*Carol Levin and Sebastian Rupley*

Pipeline *By Robin Raskin*

Headlines '95

Most of you have long since made your predictions and resolutions for 1995. Me, I've abandoned the Julian calendar in favor of the Comdex calendar. As soon as that mother of all computer trade shows is over—and I've had a chance to digest the gestalt of the thousands of products that create their own Las Vegas glitter for the week—I start writing next year's headlines in my mind. Here's what I think we'll see.

Boom Year for Mergers, Acquisitions, and Bankruptcies. If you thought that 1994 was the year of strange bedfellows, stay tuned. 1994's all-star cast featured Novell and WordPerfect, Intuit and Chipsoft and Microsoft, Altsys and Macromind, Sybase and Powersoft, Aldus and Adobe, Stac and Ocean Isle, ZEOS and Micron, and Tandy and AST. Longtime favorites like Hayes were hard hit by the skyrocketing costs of manufacturing. 1995 will bring more of the same. Companies will be sold; mergers and acquisitions will take place at a ferocious pace. At the end of the year, there will be far fewer players than at the beginning. The pattern is clear: Consolidation is the recipe for survival.

Closing the Books on Some Underdogs. Farewell noble underdogs, full of technical promise but a little long of tooth when it came to deliverables and market realities. We'll see Appware, OpenDoc, Taligent, and perhaps DEC Alpha relegated to the "whatever happened to" category. And to paraphrase Dorothy's line to the lion, "Of all the underdogs, I'll miss you most of all, OS/2." I believe that OS/2 is a terrific operating system for a niche group of nonnetworked power users.

Internet: Big-City Problems in Cyberspace. This is no longer a pleasant place where academics trade research papers, and it's no longer a place where you'll feel free to roam. Cyberspace will take on a real Wild West persona this year. There will be scams unheard of before, a nonexistent line between information and misinformation, and plenty of smart people who will lose their shirts trying to make a buck.

Other big Internet news: I've no doubt that you'll be able to browse and publish on the Internet using traditional word processing, spreadsheet, and database applications.

Phone Companies See Cash in Interactive Games. People will form groups of multiplayer communities in bigger numbers than ever before. You'll play DOOM over your phone lines, but the big question is whether the phone company will be allowed to get involved with "loser pays all" models of doing business.

ISDN Proliferates with Amazing Speed. Thanks to consumer pressure, the telephone companies have finally figured out ways to make ISDN widely available for a reasonable price. They predicted deployment by the end of the decade, but it's looking more like by the end of 1996.

Windows 95 Apps Get Off to a Slow Start. Microsoft Windows 95 will have a reasonably fast adoption rate, but Windows 95 apps will be a slower sell. The immediate advantage of Windows 95 apps is their support of long filenames, but that alone won't compel you to convert all your old 16-bit Windows apps.

The Microsoft Network Reaches 1-Million-User Mark in First Three Months. The price of entry is lower than that of any other service, and the content providers have been strong-armed into providing their best stuff. It's pretty, it's got smart agents, and the software connection comes built into the operating system.

Now for the headlines I'd like to see but probably won't:

Justice Dept. Recommends Microsoft and Intel Bust-Ups. As one analyst put it, "The DoJ is far too concerned with our GNP to try and stop Microsoft or Intel from dominating the scene." You can expect Intel to enter the PC-makers market as well.

Comdex '95 Held as a Virtual Trade Show. This is not a far-fetched idea at all. But it won't be the same until they can simulate the interminable cab lines, blistered feet, and seas of humanity.

Robin Raskin is the editor of PC Magazine.

Bridging Language Gaps in Cyberspace

WHILE 1995 MAY TURN OUT TO BE the year of the family PC, the United Nations' Year of the Family has already begun. In recognition, teenagers from Canada, France, Germany, Italy, Mexico, Spain, and the U.S. are participating in a cross-cultural technology project sponsored by the Global SchoolNet Foundation. The Family Write project connects kids around the world via e-mail. They'll use translation software to bridge the communication gap.

The assignment is to take oral histories of family members, write reports in their native languages, and exchange findings with pen pals around the world. To help get the project off the ground, Globalink, of Fairfax, Virginia, donated its expertise in language translation software and its Language Assistant software series.

The project represents a new direction for translation software at a time when it's simple to fetch on-line information from around the world via the Internet. Translation software is reaching beyond its roots in documentation to the localization of the sea of on-line information. Michael Tacelosky, CEO of Globalink, which bought out competitor Microtac last year, is now working to set a standard for language translation much as Creative Labs set the Sound Blaster standard for PC-based audio.

If Globalink succeeds, you'll be able to buy an e-mail package or word processor that's translation-enabled and then plug in a translator. The two will be integrated much as spell-checkers and word processors are today. Globalink is taking integration a step further by saving you the trouble of having to import and export a file from and to the translation program. Instead, if you receive an e-mail message in Russian, you can translate it from within the e-mail program.

While there's no questioning the need for improvements in translation algorithms, the technology continues to evolve. Developers are adding vocabulary, understanding collocation of words, and writing sophisticated rules that recognize the difference between "fired a clay pot" and "fired an employee."

Developers at Globalink have already defined the applications programming interface and expect to have a development kit ready for software vendors when Windows 95 ships. Companies interested in helping build the Global SchoolNet can contact Yvonne Andres at 619-931-5934.

—*Carol Levin*

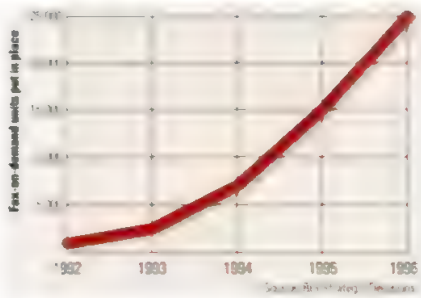
Faxback Payback

WHILE THE INTERNET AND ON-LINE services hogged the headlines in 1994, fax-on-demand—PC/phone integration that automatically faxes documents to remote callers—is growing right along with electronic information delivery.

According to BIS Strategic Decisions, approximately 25,000 new fax-on-demand—or faxback—units will be put into place in 1995, up from approximately 15,000 new units put into place in 1994.

Hans Peter Reicken, president of FaxQuest, in Sunnyvale, California, which sells a four-line faxback solution for $2,195, says he doesn't even believe that electronic information delivery is faxback's most pressing competition. "We compete with the millions of people out there standing over fax machines and stuffing envelopes; these are just not efficient, money-saving solutions," he says. FaxBack Inc., of Beaverton, Oregon, provides $10,000 to $20,000 high-end faxback systems that support as many as 48 lines. According to the company, a single system is saving a division of Intel $6 per customer fulfillment on 2,000 fulfillment requests per month.

A word to the wise: Plan ahead for cost efficiency. The first choice to make is whether to go with a one-call or two-call system. A *one-call system* means that the caller pays as a document is faxed out during the initial call. The more common *two-call system* means that the requested fax is put into a queue and sent out on a second call—so the faxback provider pays. The most flexible faxback systems can reverse charges to a caller by switching from two-call mode to one-call mode, if, say, an international call comes in. It's also important to plan for expansion. Novell stores more than 10,000 documents and has recently upgraded from 12 inbound and outbound lines to 24.



Faxback technology has some growing to do as well. The software, for example, doesn't have document management smarts. The best software tracks changes and versions of archived documents, but don't expect elegance. Also, very few faxback solutions offer credit card verification, and even fewer allow for remote loading of documents.

Still, while electronic delivery of information continues to gain momentum every day, faxback's momentum is proof that you cannot count out hard copy. —*Sebastian Rupley*

Top Retail Software

Current ranking	Last issue	Product company
1	1	**Headstart Turbo Tax Federal '94** *Intuit*
2	—	**OS/2 Warp, Version 3.0** *IBM Corp.*
3	—	**MS Excel 5.0 for Windows Upgrade** *Microsoft Corp.*
4	2	**MS-DOS 6.22 Upgrade** *Microsoft Corp.*
5	—	**Quattro Pro 6.0 for Windows Upgrade** *WordPerfect, the Novell Applications Group*
6	4	**MS Works 3.0 for Windows with Money 3.0 for Windows** *Microsoft Corp.*
7	—	**Uninstaller 2.0** *MicroHelp*
8	5	**Procomm Plus for Windows 2.0** *Datastorm Technologies*
9	9	**MS Office 4.2 for Windows Upgrade** *Microsoft Corp.*
10	—	**Quicken 4 for Windows Deluxe CD** *Intuit*

This list ranks PC business programs according to the total number of copies shipped to over 12,000 stores and resellers in the week ending November 12, 1994; the list cannot be interpreted as a picture of the entire software market. Sales information adapted from a compilation by Ingram Micro.

CD-R: Born to Burn

YOUR NEXT PC MAY COME WITH A drive that not only plays CD-ROMs but also records them, thanks to several advances in recording technology made over the past year. Mastering CD-ROMs on your desktop is now more attractive for a range of applications, including multimedia presentations, desktop publishing, electronic prepress, graphic design, and archiving.

Refinements in laser technology, the drop in cost of CD—recordable (CD-R) drives, and the miniaturization of components are driving this trend, explains Rich Buchanan of Creative Labs. The first CD-R drives, introduced in 1989, cost around $25,000 and took 80 minutes to record. Today, prices on CD-R drives are dropping to under $2,000; recording takes about half an hour.

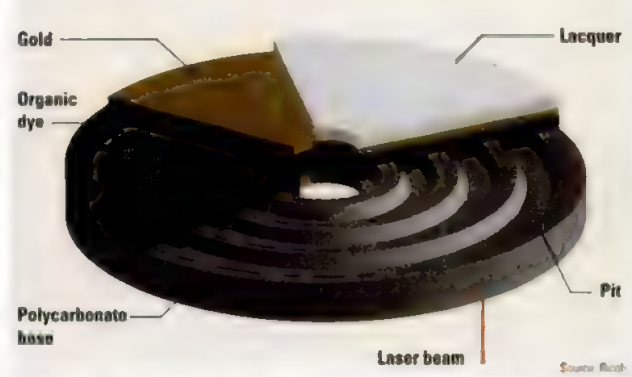
In the meanwhile, researchers continue to make improvements in the optical sensitivity of the organic dye—the actual recording medium on the disks. The laser in a CD-R drive melts the dye and embeds the information in a series of pits, a process known as "burning." Once the information is recorded, the layer of organic dye is altered and cannot be changed; that's why you can only record once. The recorded disk can then be read by a standard CD player or CD-ROM drive.

Later this year, Creative Labs, which recently introduced its Digital Edge CD-R (an external drive) for under $2,000, expects to offer a quadruple-speed CD-R. A 4× drive takes about 18 minutes to record 74 minutes of digital audio or data to a 650MB disk; a 2× drive takes about 36 minutes.

On the software side, Corel has a new premastering program, Corel CD Creator, which simulates the completed CD-ROM on your hard disk before recording it to the CD-R. Once Creative Labs solves some heat dissipation issues later this year, watch for half-height internal CD-ROM player/recorders in one.—*Carol Levin*

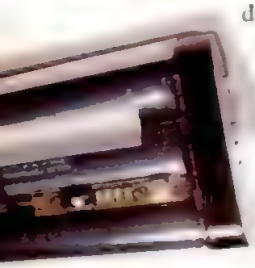
How a CD-R Drive Writes Data

A CD-R drive focuses a laser beam through the polycarbonate base onto the layer of organic dye, burning pits into the disk's surface. The pits alter the reflectiveness of the gold layer.



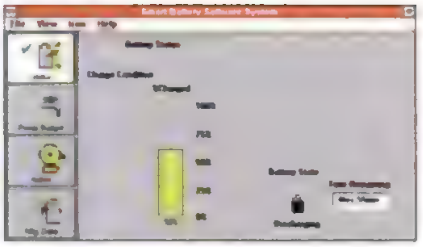
Batteries That Think

JUST HOW FAR ARE YOU WILLING to go for an extra 4 hours of battery life? Would you schlepp an extra pound or shell out an extra hundred dollars? Most people would accept an extra 12 ounces, a smaller keyboard, and a quarter-inch in size, and would pay an extra $100 for a notebook that delivered an extra 4 hours of juice, according to a survey of mobile computer users by H&M Consulting.



Duracell's battery chip.

Momentum is building now for a "smart battery" standard designed to improve runtimes. Unlike conventional batteries, an intelligent battery is equipped with a chip that issues accurate reports on battery conditions. IBM has developed its own solution for its ThinkPad notebooks, and over a dozen manufacturers, including Canon, Citizen, and Compaq, have signed on to the Intel/Duracell Smart Battery Data Specification, a fledgling standard that defines the pathway for communication among the smart battery, the notebook, and the charger.



SystemSoft's smart battery software displays precise status information.

Today, most notebooks come with a battery indicator that estimates remaining time. According to Duracell, inaccurate estimates can result in up to 20 percent of the battery's overall life not being used. A smart battery collects and communicates a range of statistics such as capacity, chemistry, remaining battery time, temperature, and voltage. According to SystemSoft, which has written a smart battery interface, a notebook with a smart battery lasts longer because users are given accurate battery status and can budget battery life with power management tools.

Smart batteries that are based on the Intel/Duracell specification have two basic components: the System Management Bus (SMBus), which is an extension of a notebook's BIOS, and a microcontroller located on the battery that stores data about the battery and monitors its status. Information such as remaining battery time is transferred over the SMBus to the system and displayed on-screen. Since the standard is chemistry-independent, it supports nickel hydride, nickel cadmium, and lithium ion batteries.

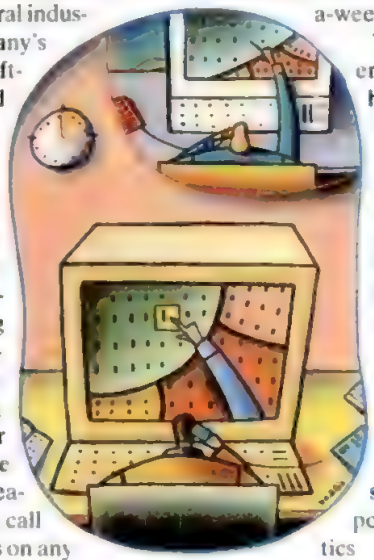
BIOS makers Phoenix Technologies and SystemSoft recently introduced Windows applets for managing notebook batteries. And this spring Canon will debut its Innova Book, and NoteJet portable products, which use Intel/Duracell smart batteries.

—Carol Levin

To Whom It May Concern: Help!

THERE YOU SIT, STALLED BY A software problem. You don't just want answers, you want answers fast. Who're you gonna call? These days, you're likely to call for support from an unaffiliated third party rather than the software publisher.

According to a recent Dataquest survey of 221 corporations in several industries, 40 percent of a company's budget for employees' software support goes to third parties.



Is third-party support a perfect solution? Definitely not. Certain kinds of software don't even make the list. Software Support (Heathrow, Florida; 800-756-4463), a leading third-party provider, supports more than 150 titles but not a single accounting package, CAD program, or programming tool. The company's fees are very reasonable, though, and you call one number to get answers on any supported title. Corporations pay Software Support $170 per user for one year of 24-hour, 7-day- a-week support. A noncorporate user buying the same level of support pays $199.95. Corporate Software (Norwood, Massachusetts, 800-677-4000) provides third-party support for far more titles—over 800—and charges different prices for various levels of support. The company's Silver support plan, for example, costs $15,000 for one year of 24-hour, 7-day-a-week support for five users.

Third-party support won't entirely supplant in-house help desks. Dataquest's survey respondents are less willing to outsource certain kinds of problems than others. Which type of support is least likely to be sought out-of-house? Disaster recovery. Over 45 percent of respondents said they're not willing to outsource such support.

Meanwhile, third-party tech- support companies are increasing the sophistication of their support with remote-diagnostics software. Staffers at Software Support field about 15,000 calls a day and can access system inventories remotely by modem and avoid lengthy interviews with callers. Many PCs already come preloaded with remote-diagnostics software, and later this month, Traveling Software plans to announce that a major PC maker will preload LapLink for Windows on its systems, which will link users directly to the manufacturer for support.

Whether the support staffer you call accesses your system from afar or resorts to old-fashioned Q&A, it's less and less likely that you'll be talking to a software publisher.—*Sebastian Rupley*

What Stays In-House And What Doesn't

Does third-party support mean one-stop shopping? Not quite. Many corporate managers aren't willing to farm out installation and disaster-recovery problems.

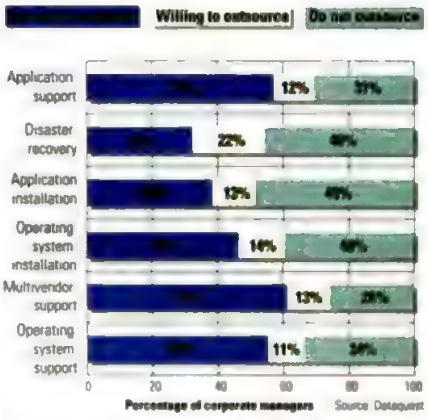
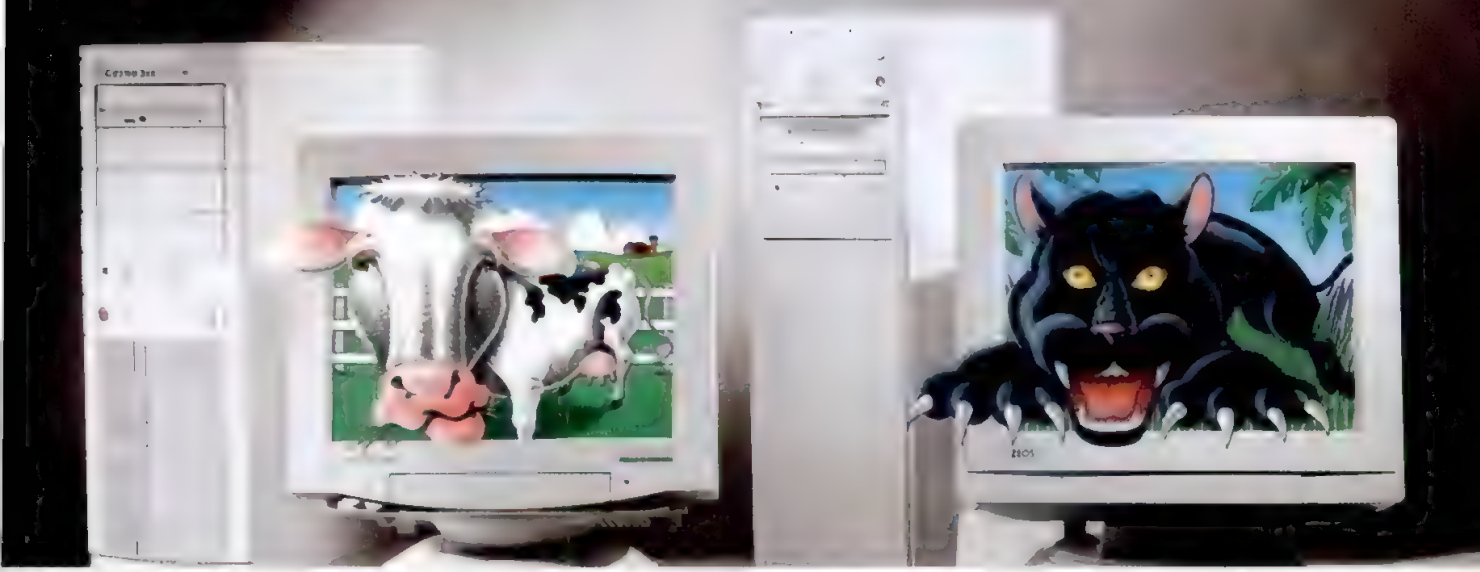
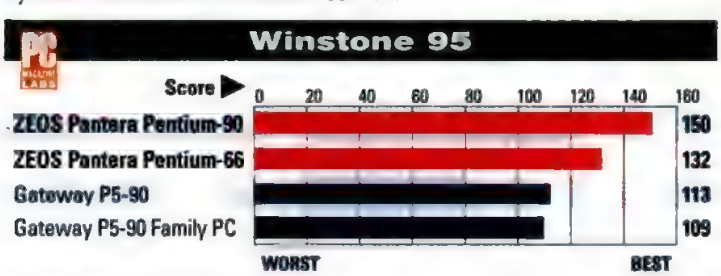


Illustration by Kurt Vargo

One Slow Cow Is One Fast Cat.



While they're grazing, ZEOS is blazing...and setting new records. In a December 6, 1994 comparison report, *PC Magazine* benchmarked 96 Pentium processor-based systems. The ZEOS Pantera Pentium-90 earned the highest Winstone 95 score of *all* machines tested, and the Pantera Pentium-66 easily passed both of Gateway's Pentium-90 PCs! If you're after performance (and who isn't?), then get a Pentium processor-based system. But, as the benchmarks prove, not all Pentium PCs deliver. The ZEOS Pantera will give you unbeatable performance and the highest quality features—all at an affordable price. And it's ready to ship *today!* For the fastest, hottest Pentium-based PC, call a ZEOS Systems Consultant now at 800-554-7172.



Reprinted from PC Magazine, *December 6, 1994*

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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

■ Portable PCs

Six Notebooks That Push the Status Quo

The pace of development in the portable PC business is so swift that every notebook year is equivalent to at least three calendar years. The continual turnover of products virtually ensures that several new systems will miss our periodic feature review articles. These six late-arriving notebooks represent the very latest ideas in squeezing maximum performance and battery life from a small and light package.

Rather than any radical departure from the notebook status quo, each of these products focuses on optimizing one of the following: battery life, performance, or size. Compare these notebooks to the 68 systems reviewed later in this issue (see "Power to Go") for the most up-to-date view of the portable PC market.

DIGITAL HINOTE CT475

Digital Equipment Corp. has made a name for itself in the notebook market by relabeling other vendors' portable computers and marketing them with varying degrees of success. Digital makes a fresh start with the HiNote series of notebooks (manufactured by Japan-based Citizen). Overall, the new HiNote is good-looking, lightweight, and performs up to snuff.

In terms of size, the HiNote shines: It measures a slim 1.7 by 11 by 8.5 inches, and boasts a travel weight of 6.5 pounds (making it one of the lightest notebooks around). Despite its size, Digital hasn't skimped on features. The $4,399 HiNote CT475 we tested came with a DX4/75 processor, 8MB of system memory, a 340MB hard disk, and a sharp 9.5-inch active-matrix color display. The system also features a full-size keyboard with a large, comfortable trackball and an LED status panel located just to the right of the screen. The unit's PCMCIA slot accomodates one Type III or two Type II cards.

LIGHT LOAD: *With a travel weight of less than 7 pounds, the Digital HiNote CT475 is the easy traveler of the group.*

On our benchmark tests, the HiNote achieved average or higher than average scores across the board compared to other DX4/75-based systems. The high point was its Graphics WinMark 95 score of 4 million pixels per second; the low point was its DOS Disk result of 309. The HiNote's nickel metal hydride battery lasted a shade under 2 hours on our WinDrain test.

Unfortunately, the unit has a flexible, almost flimsy feel—possibly due to its reduced weight. Despite this minor flaw and its mediocre DOS performance, the HiNote represents an

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■ Word Processors

WordPerfect Adds Speed and Grace to Power

BY EDWARD MENDELSON

With Version 6.1, WordPerfect for Windows finally feels comfortable in the Windows environment, and begins to make the most of its home. This $395 full-featured word processor—the first version since Novell acquired WordPerfect Corp.—looks sleeker, works faster, and offers a more cohesive look and feel compared to the often chaotic interface of Version 6.0. In addition, WPW6.1 breaks new ground with its use of linguistic intelligence to boost the power of document searching. The end result: WPW6.1 stands ahead of Microsoft Word for Windows and Lotus Ami Pro in the race to be the most complete word processor.

GRAPHIC: *WordPerfect's Drop Cap toolbar provides full typographic options for creating and placing initial capital letters.*

Best of all, WPW6.1 will not require extensive retraining for current users of Versions 6.0 or 6.0a. The program's toolbar buttons continue to allow you to use text or icons (or both) to represent commands—unlike Word and Ami Pro, which force you to interpret icons. The new version's menus and syntax are mostly unchanged, with sev-

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Portable PCs

CONTINUED FROM PAGE 37

impressive new direction for Digital notebooks.
—Asa Somers

▶ **Digital HiNote CT475.** List price: *With DX4/75 processor, 8MB RAM, 340MB hard disk, 9.5-inch active-matrix color display, $4,399.* Digital Equipment Corp., *Acton, MA; 800-722-9332, 603-884-4304; fax, 800-524-5694.*
Circle 431 on reader service card

EVERYTHING INCLUDED: *The HP OmniBook 4000 CT's greatest strength is that it is a full-featured, presentation-ready notebook with an excellent display.*

HP OMNIBOOK 4000 CT

Hewlett-Packard Co. has a well-earned reputation for shoehorning a lot of computing power into a small space. With its OmniBook 4000 CT, HP successfully reaches beyond its 200LX palmtop and OmniBook 600 subnotebook to compete in the full-featured notebook market.

Rather than build its new OmniBook from scratch, HP engineers looked east and worked with Taiwan-based Twinhead Corp. The major difference between the OmniBook 4000 CT and Twinhead's Slimnote 5 line of notebooks is that HP engineers chose to use the more traditional center-mounted trackball rather than the Slimnote's more eclectic touch pad. Equipped with a DX4/100 processor, 8MB of system memory, a 520MB hard disk, and a brilliant 10.4-inch active-matrix screen, the OmniBook 4000 CT sells for $6,510.

Despite its Transpacific lineage, the OmniBook 4000 CT continues HP's use of infrared data communications; the system can send and receive files and print wirelessly. The OmniBook also has a Type III PCMCIA slot that can accomodate a pair of Type II cards. Moreover, the system breaks new ground for HP with the inclusion of 16-bit stereo sound. In fact, the sound quality from the built-in microphone and speakers is surprisingly good, making the notebook a good choice for multimedia presentations.

The OmniBook 4000 CT proved itself to be a power portable aimed at graphics-based applications with a Graphics WinMark 95 score of 5.3 million pixels per second. Its battery's WinDrain time of 1 hour 28 minutes was subpar, however. The system's power management software includes a variety of battery-saving features as well as an effective suspend mode that saves all active windows to disk prior to shutdown. If that isn't enough, you can swap the unit's floppy disk drive for a second battery pack for greater longevity.

On the downside, the system's AC adapter requires a three-prong grounded plug, and the unit's 7 pound 12 ounce travel weight is a bit on the heavy side.—*Brian Nadel*

▶ **HP OmniBook 4000 CT.** List price: *With DX4/100 CPU, 8MB RAM, 520MB hard disk, 10.4-inch active-matrix color display, $6,510.* Hewlett-Packard Co., *Corvallis, OR; 800-443-1254, 503-715-2004.*
Circle 432 on reader service card

TWO-OF-A-KIND: *Differing only in display technology, the IBM ThinkPad 360CE (right) and the IBM ThinkPad 360CSE (left) are both good value notebook choices.*

IBM THINKPAD 360CE
IBM THINKPAD 360CSE

If you want a ThinkPad 755CE, but your budget can't handle its $6,000-plus price tag, you may want to consider IBM's value-minded ThinkPad 360CE or 360CSE notebooks.

The latest additions to IBM's notebook line have 50-MHz 486DX2 processors and can carry enhanced IDE hard disk drives of 810MB. These wallet-conscious ThinkPads are identical in all respects but one: The $3,699 360CE is outfitted with an 8.4-inch active-matrix color display, while the $3,349 360CSE has a 9.5-inch dual-scan passive-matrix color screen. Each ThinkPad carries a pair of Type II PCMCIA slots that can hold a single Type III card.

Both units we tested had 340MB hard disks (170MB, 540MB, and 810MB hard disks are also available) and 8MB of system memory (expandable to 20MB). In terms of performance, the two ThinkPads turned in similar scores. The active-matrix color unit produced slightly better DOS Video, Graphics Winmark 95, and Winstone 95 results, but overall, both systems proved to be solid—though not stellar—performers. Based on our WinDrain battery test, expect about 2.5 hours of life between charges for each notebook.

Benchmark Tests: Notebooks

For the most part, these six notebook PCs were average performers. The stand-out results were the HP OmniBook 4000 CT's Graphics WinMark 95 score of 5.3 million pixels per second and the IBM ThinkPad 360CE's WinDrain battery life of 2 hours 44 minutes.

PC Magazine Labs used Winstone 95, Version 1.0; WinBench 95, Version 1.0; and PC Bench, Version 9.0, to measure the performance of these notebook PCs. All were equipped with 8MB of RAM

Higher scores represent better performance.	Winstone 95 (score)	Graphics WinMark 95 (millions of pixels per second)	Disk WinMark 95 (score)	DOSMark (score)	CPUmark$_{32}$ (score)	DOS Video (score)	DOS Disk (score)	WinDrain (hours:minutes)
Digital HiNote CT 475 (DX4/75)	49	4.0	370	386	61	2,821	309	1:53
HP OmniBook 4000 CT (DX4/75)	50	5.3	287	490	75	4,419	387	1:29
IBM ThinkPad 360CE (486DX2/50)	38	2.4	207	330	48	3,990	269	2:44
IBM ThinkPad 360CSE (486DX2/50)	36	2.3	188	324	48	3,568	259	2:25
ZDS Z-Noteflex (DX4/75)	47	3.5	331	394	57	2,555	363	2:06
ZDS Z-Star EX (486DX2/50)	38	2.2	197	306	48	2,063	248	1:22
Average notebook PC (based on "Power to Go" in this issue)	49	3.5	253	405	66	2,933	338	1:58

With identical keyboards (featuring the TrackPoint III pointing stick), the 7 pound 1 ounce 360CE and the 6 pound 13 ounce 360CSE are so much alike that when deciding between the two, your choice will boil down to which screen you like better: the 360CE's sharp, high-contrast 8.4-inch active-matrix display (which offers wide viewing angles) or the 360CSE's larger, 9.5-inch dual-scan passive-matrix screen (which may ease eye strain when working on spreadsheets).

Either way you go, you win, because both notebooks successfully carry the ThinkPad pedigree.—*Tin Albano*

▶ **IBM ThinkPad 360CE.** List price: *With DX2/50 CPU, 8MB RAM, 340MB hard disk, 8.4-inch active-matrix display, $3,699.* **IBM ThinkPad 360CSE.** List price: *With DX2/50 CPU, 8MB RAM, 340MB hard disk, 9.5-inch dual-scan display,* $3,349. IBM Personal Computer Co., *Somers, NY; 800-772-2227, 914-766-1900; fax, 800-426-4329.*

Circle 433 on reader service card

ZDS Z-NOTEFLEX
ZDS Z-STAR EX

Modularity is the key to Zenith Data Systems' high-end Z-Noteflex and budget-oriented Z-Star EX notebooks. Both feature user-upgradable displays, RAM, and hard disks, while the more robust Z-Noteflex allows processor upgrades. For $2,699, the Z-Star EX packs enough power and features for most business users, while it's $5,819 sibling is more suitable for multimedia applications.

MODULAR EVERYTHING: *Zenith's Z-Noteflex notebook has the capacity to exchange its display, hard disk, and processor.*

The Z-Noteflex we tested came equipped with a DX4/75 processor, 8MB of system memory (expandable to 20MB), a 340MB hard disk (450MB and 520MB hard disks are also available), and a 9.5-inch active-matrix color screen. In addition, you get built-in 16-bit stereo sound, speakers, and a microphone—the basic ingredients needed for multimedia presentations. These extras, of course, add to the unit's weight: You'll heft a 7 pound 13 ounce system when you take to the road.

A Cyrix 486DX2/50 processor is the only processor available for the Z-Star EX. Our system came with 8MB of system memory (expandable to 20MB), a 340MB hard disk, and a 9.5-inch dual-scan color display. This package had a very impressive travel weight of 6 pounds 8 ounces. Instead of the traditional notebook trackball, the Z-Star EX uses a J-Mouse, which is controlled by pressing on the edges of the J key; the two actuation buttons are on the wrist rest below the keyboard.

In terms of performance, the Z-Noteflex was on a par with other DX4/75-based notebooks; the Z-Star EX, on the other hand, dipped a little below average when compared to its stiff competition in DX2/50-based systems. Battery life (based on our WinDrain test) was a disappointing 1 hour 22 minutes for the Z-Star EX, but a more pleasing 2 hours 6 minutes for the Z-Noteflex. If battery life is critical, you can exchange the floppy disk drive in either system for a second battery pack—which will set you back $79 for the Z-Star EX notebook and $129 for the Z-Noteflex.—*Jodi L. Wynblatt*

▶ **ZDS Z-Noteflex.** List price: *With DX4/75 CPU, 8MB RAM, 340MB hard disk, 9.5-inch active-matrix color display, $5,819.* **ZDS Z-Star EX.** List price: *With Cyrix 486DX2/50 CPU, 8MB RAM, 340MB hard disk, 9.5-inch dual-scan color display, $2,699.* Zenith Data Systems, *Buffalo Grove, IL; 800-533-0331, 708-808-5000; fax, 800-472-7211.*

Circle 434 on reader service card

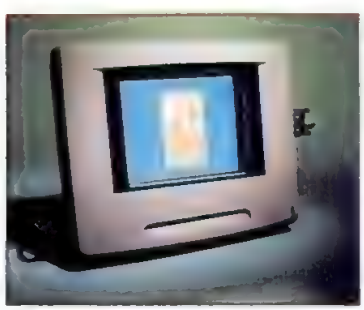
BUDGET BOOK: *The ZDS Z-Star EX provides a lot of notebook value for the dollar.*

▪ Sharp QA-1500: *PCMCIA Comes to Projection Panels*

The next time you have to give a multimedia presentation on the road, leave your notebook at the office. With Sharp's QA-1500 LCD projection panel, you can store about 100 individual images on a standard PCMCIA card, and use the panel's wireless remote to control your presentation.

The QA-1500 weights 5.5 pounds and features an 8.4-inch active-matrix color display that's capable of showing 1.7 million colors at 640-by-480 resolution. The 2- by 13- by 10.6-inch panel includes composite-video inputs (NTSC, PAL, and SECAM), built-in speakers, and jacks for line-level audio input and output.

To begin, plug the QA-1500 into your notebook and run your presentation; the panel grabs the images and stores them in a proprietary format on a 105MB Type III PCMCIA card. Once on-disk, we found it easy to manipulate the order of the images and add transitional effects. The panel, which is operated by an infrared remote control, has on-screen menus that guide you through all its operations. The remote can also learn up to five functions of another infrared remote, so during your presentation, you can run a VCR without having to juggle remote controls on stage.



CARD VIEW: *Sharp's QA-1500 uses a PCMCIA hard disk.*

At $5,795, the QA-1500 LCD panel costs a pretty penny, but you'll find that the device—with its PCMCIA capabilities and remote control—can really brighten up your next presentation.—*Tin Albano*

▶ **QA-1500.** List Price: *$5,795; with backlight option, $5,995.* Sharp Electronics Corp., *Mahwah, NJ; 800-237-4277, 201-529-8731; fax, 201-529-9636.*

Circle 435 on reader service card

WordPerfect 6.1

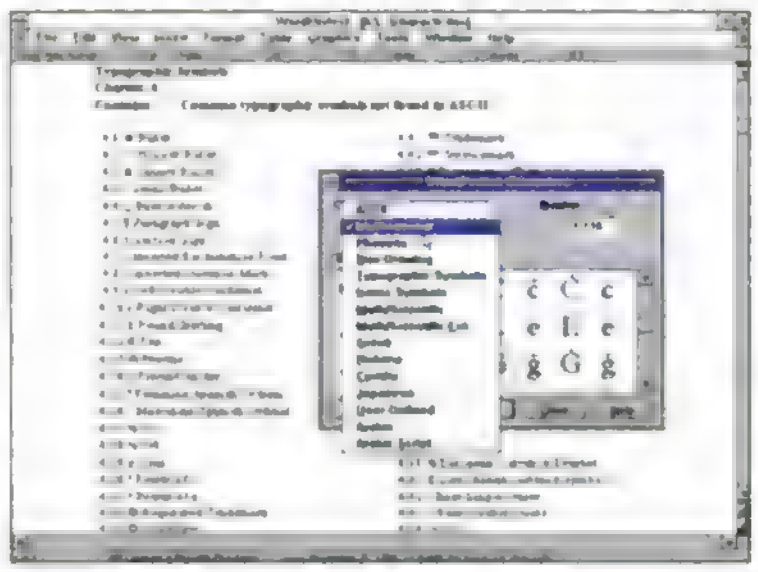
CONTINUED FROM PAGE 37

eral important new features unobtrusively slipped in.

The biggest advance to note is the set of improvements made to WordPerfect's preeminent file management system. These enhancements push this feature even further ahead of the competition. By applying linguistic rules, WPW6.1 builds on the power of the written word. For example, we were able to search for and replace the different forms of the word *find*. WPW6.1 successfully scanned the document for all instances of find, finding, and found. We were also able to construct complex search queries that not only included multiple forms of a word, but were based on synonyms, phonetic equivalents, and linguistic details. This level of ease and flexibility isn't matched by even the best standalone indexing programs, and puts WordPerfect lightyears ahead of Word's primitive file management functions.

As in previous versions, WPW6.1 provides a full-featured file manager in every file-selection dialog box, complete with named directories, descriptive filenames, customizable file displays, and a searchable file viewer. For those who need to store several revisions to a file, WPW6.1 offers a check-box that lets you open an existing file under a new name so changes won't affect the original. Although WPW6.1's Grammatik 6 grammar-checking program uses the same linguistic technology as the word processor and remains superior to similar products, it still wastes more time flagging correct sentences than it saves by deleting erroneous ones.

Many of WPW6.1's improvements leapfrog over similar features in Word and Ami Pro. WordPerfect is now an OLE 2.0 client and server, and it is able to drag-and-drop items across applications. In addition, WPW6.1 comes equipped with edit-in-place applets that you can use for charting, drawing, and font special effects. These modules generally outclass those found in Word and Ami Pro. The WordPerfect equivalent of Word's Table Wizard, for example, allows you to add custom formats to the supplied formats. On the other hand, WPW6.1's clunky equation editor is out of place in a graphics-based environment.



GLOBAL: *WordPerfect has built-in font support for all major languages and standard typographic and scientific symbols.*

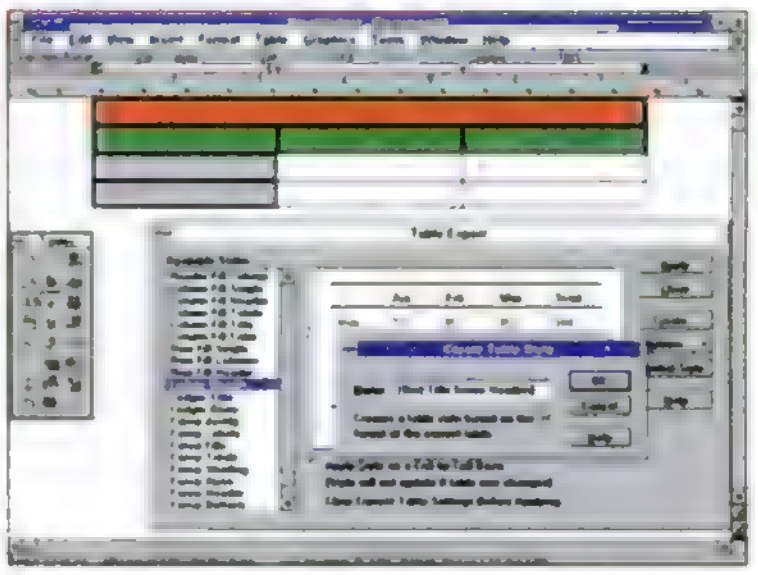
STREAMLINED OPERATIONS

Many functions in WPW6.1 that used to require multiple steps now need only one. For instance, we scanned an image directly into a document without first opening the graphics module, and were able to use the mouse to create and position a graphics box, then immediately insert a graphics element. And when we created a floating cell to display the contents of a spreadsheet cell in the midst of a document, the program automatically opened the toolbar for inserting the data. On the other hand, customized outline styles and numbering schemes are still frustratingly complex.

As good as WPW6.1 is, there are several areas that need refinement. To determine and define formatting and styles, you still have to work with an awkward Reveal Codes window. When you create styles that include outline headings, one of the drop-down menus descends invisibly below the bottom of the screen. Furthermore, you can work your way through half a dozen menus and commands only to get an error message telling you that you can't use the menus when defining styles. And when you create a large bookmark, you run the risk of wiping out any smaller bookmarks underneath.

Moreover, despite WordPefect's unique ability to handle international languages, some of the basic fonts occasionally produce odd effects. Monospaced typefaces like Courier appear onscreen squashed vertically and stretched horizontally.

File conversions are more reliable than previous WordPerfect versions, although still not perfect. Importing a Word document can result in something that is almost unrecognizable. You're better off exporting the Word document as a WordPerfect 5.*x* file and then opening it in WordPerfect 6.1.



EXPERT ADVICE: *WordPerfect's Table Expert lets you add your custom table formats to the menu of built-in selections.*

If at any point you find yourself confused or lost in WordPerfect's intricacies, the manual—although better than previous versions—may not prove much help. It remains more of an alphabetical list of features than a program guide. By contrast, the program's help files are finally detailed enough to be of assistance, and an expanded series of Coaches guide the uninitiated WordPerfect user through real-world procedures.

Network administrators and support staff will welcome a new usage-log feature that records the times when files were saved or changes were discarded, and warns the user of any errors in saving files. Users who purchase the CD-ROM version will get voice-command software that lets them control WPW6.1 by telling the program to "bold word" or "close file." While of limited use at this point (and requiring a sound card, microphone, and an abundance of patience), the voice recognition module provides a tantalizing glimpse of the future of word processing.

All told, WordPerfect 6.1 finally has much of the elegance, efficiency, and speed that the enormous power of this program has long deserved. As a market contender against Word for Windows and Ami Pro, WordPerfect for Windows has always had plenty of muscle. Now it has some quickness and grace, as well.

► **WordPerfect 6.1 for Windows.** List price: *$395; upgrade, $95.* Requires: *6MB RAM, 15MB hard disk space, Microsoft Windows 3.1 or later.* WordPerfect, The Novell Applications Group, *Orem UT; 800-451-5151, 801-225-5000; fax, 801-222-5077.*

Circle 436 on reader service card

FIRST LOOKS PLUS

From January 9 through 13, you can go on-line to discuss WordPerfect 6.1 for Windows with reviewer Edward Mendelson, WordPerfect product manager Shaun Stirland, and director of research Dave LeFevre. Type GO EXEC at any CompuServe ! prompt.

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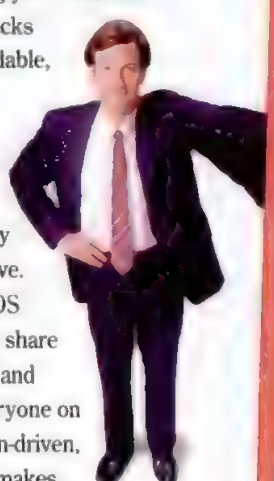

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■ Multimedia Authoring

Macromedia's Director: Lights, Camera, Action for the PC

BY LORI GRUNIN

Macromedia's Director comes to the PC from the Macintosh world with a mixed—though generally impressive—reputation as a powerful tool for producing multimedia presentations, demo disks, and kiosk applications. Yet its steep learning curve and $1,195 price tag may discourage all but the most serious users. In practice, we found that once you understand Director for Windows 4.0's mindset, it's easy enough to learn the ins and outs of this intricate program. Director does have a few unexpected warts, however.

Director's greatest strength is that it uses movie production as an organizing metaphor. This makes creating a presentation—called a movie—easily understood. Each movie has a cast consisting of such diverse elements as bitmapped sprite images that can be animated, music and sound files, scripts, and palettes.

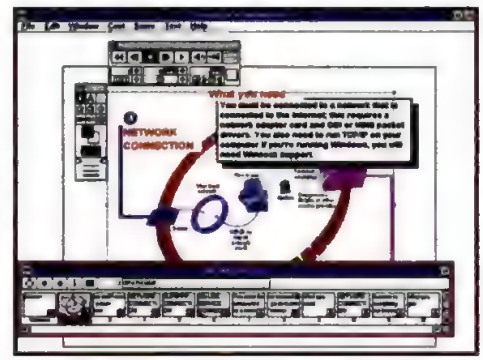
To create a movie, you place objects on the stage and control their timing, transitions, movements, and juxtapositions via the frame-based score. Director supplies basic tools for manipulating bitmaps; for generating animation segments by either producing in-between frames or real-time recording; for adding text; and for creating scripts that control flow and interactivity at the sprite, cast member, or frame level. You can import a wide variety of file formats—although all vector formats come in as bitmaps—and certain types of files may only be linked rather than embedded.

The program's native .DIR format allows the sharing of files with the Macintosh version of the product, though we noticed that some transitions and palettes behaved erratically. Director can create a PC-only runtime file called a projector. Projectors can get fairly big, since they contain all embedded objects; a 2.5 minute movie with 6 embedded .WAV files ran about 3.3MB, so it pays to keep a tight lid on your cast members.

SPEAK THE LINGO

Lingo, the package's English-like, object-oriented script language, proved to be an easy way to write simple macros. For instance, we created a quick-and-dirty button to jump to another segment of the movie. With the included button tool, we drew a button, then entered "go to frame *x*," where *x* refers to a previously defined frame marker in the movie.

In addition to standard programmer's tools such as looping controls, trace debugging, and control of external devices such as CD-ROM drives, Lingo provides class objects and instances called Parent, Child, and Ancestor objects. In Lingo, scripts spawn and control physical animated objects. The bottom line is that unless you're an experienced programmer, Lingo can get tougher as you delve deeper; the two-volume Lingo documentation clears up most misunderstandings.



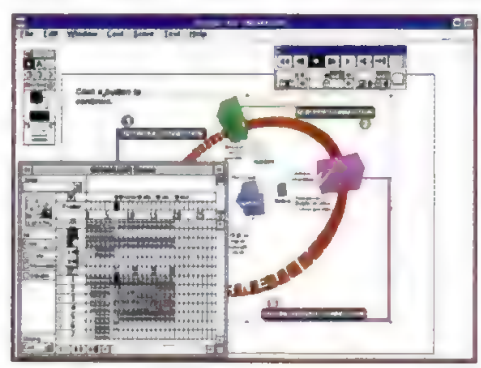
ROLES: *Every element in a Director movie, including scripts, palettes, and buttons, is loaded into the movie's cast.*

The program also provides many much-needed tools for multimedia application developers, such as the ability to set a limit on the amount of memory you want an application to use. Director will display a warning when the resources (cast members) you've loaded exceed that limit. Additionally, the program lets you specify how cast members should be loaded into memory (as needed, or before or after the first frame), as well as their priority for being purged.

These controls, unfortunately, don't go quite far enough. For instance, you can't force a movie to purge resources that you know won't be needed again; you must wait until available memory gets low before the program decides to purge. While Director shows a breakdown of your current memory allocations, the program offers no indicators of how individual cast members consume resources so that you can slim down the offending objects. Although Director offers several tools for controlling application playback on different types of hardware, they are either based on frames per second or seconds per frame. There is no information on how to optimize for a specific data rate (such as 150 Kbps for single-speed CD-ROMs).

In addition, there are very few automation possibilities. You must manually build shared palettes, and Director doesn't support drag-and-drop for certain aspects of script creation. Unlike programs intended for creating computer-based training applications, such as Macromedia's Authorware, Director lacks a flowchart view or other way to give the programmer an overview of the logic of the application being created. Some omissions annoy rather than impinge on a developer's creativity; for instance, the Paint window for importing and working on images lacks an undo feature. And if you export a movie as an .AVI file, it must be as a silent movie.

Keep in mind that these blemishes are minor compared to what is possible with Director. Flaws and all, Director remains the premiere tool for kiosk and distributed multimedia application development.



SCRIPT: *The frame-based score is comprised of the cast members, durations, scripts, transitions, and other properties of a Director movie.*

▶ **Macromedia Director 4.0 for Windows.** List price: *$1,195; upgrade, $349.* Requires: *4MB RAM (8MB RAM for authoring; 16MB recommended), 40MB hard disk space, Microsoft Windows 3.1 or later.* Macromedia Inc., *San Francisco, CA; 800-288-4797, 415-252-2000; fax, 415-626-1502.*

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CIRCLE 098 ON READER SERVICE CARD

Travel

QuickXpense Does the Expense Account Dirty Work

BY CRAIG STINSON

Portable Software's QuickXpense is a one-trick pony: All it does is automate the preparation of expense reports. Yet it does this onerous task so well, it should appeal to anyone who travels for a living. The $99.95 program handles an impressive variety of expense recording and reporting needs, and hides its complexity behind one of the best user interfaces around.

QuickXpense offers a choice of 15 expense report forms, including standard weekly, biweekly, semimonthly, and monthly forms, as well as those tailored for the needs of consultants, lawyers, realtors, and salespeople. In addition, for $49.95, Portable Software will create an electronic version of your company's form for use with QuickXpense (Fortune 1000 companies can get their custom forms created for free).

QuickXpense works well on the road because entering data is easy. Like Microsoft Money and Quicken, QuickXpense anticipates your data entry needs. Out of the box it knows the names of the principal car rental firms and hotel chains—so with a click of a mouse button, you can pick Hertz or Hilton from a drop-down list. When you enter a new name, QuickXpense adds it as a menu pick. We found that as we used the program, it learned our favorite watering holes.

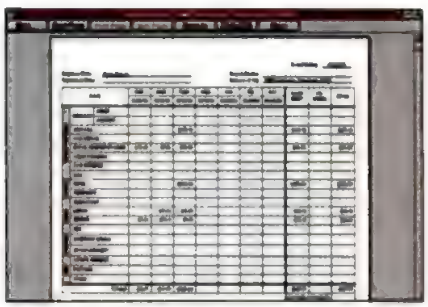
The program handles such details as cash advances, company cars, and company credit cards. QuickXpense can also generate detailed breakdowns of meetings and events, listing attendees, the purpose of the meeting, and so on. Expense reports that include currency conversions detail the reimbursable amounts in the home currency, but also generate an itemized listing of your foreign-currency transactions. There's even a reminder that appears around the time you should expect a reimbursement check. All expense reports are stored in a database, and the program provides reporting tools for analyzing spending patterns.

If you use ACT! or WinFax PRO, QuickXPense can read your contact lists. You can also create links to files in .DBF databases or delimited formats.

All in all, this is one smart and useful piece of software.

▶ **QuickXpense.** List price: *$99.95 (introductory price, $69.95).* Requires: *2MB RAM (4MB recommended), 2MB hard disk space, Microsoft Windows 3.1 or later.* Portable Software Corp., *Bellevue, WA; 800-626-8620, 206-637-8808; fax, 206-637-8828.*

Circle 420 on reader service card



TRACK: *QuickXpense can keep track of individual expenses and organize spending by trip.*

Document Management

InTEXT Puts a Finger on Information

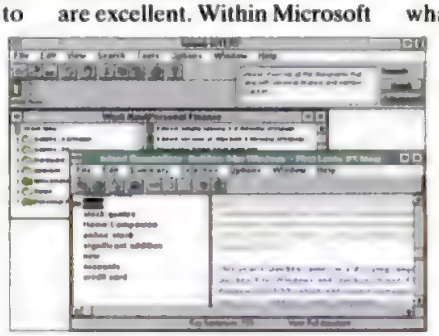
BY GREGG KEIZER

Information may be power, but unless you know where each piece of data lurks, that power may be only so much unused potential. Island Software's $399 InTEXT for Windows is a network-capable text- and document-management package that uses simple English requests to retreive documents.

Based on a hierarchical file cabinet/folder metaphor, InTEXT uses SmartFolders to organize documents that originated in Microsoft Word for Windows, WordPerfect for Windows, Lotus Ami Pro, Microsoft Write, or any ASCII-based application. Rather than force you to manually deposit documents in folders, InTEXT automatically fills folders based on filters that you set. Though not foolproof, we found this to be a quick way to categorize information.

Before documents are available for search and retrieval, they must be indexed. A 5,000-word document took a minute and a half to index over a Windows for Workgroups network. Once indexed, documents can be retrieved with simple English requests—such as "Show me all documents that deal with personal finance and mention Lire"—rather than cryptic keywords and complex logical separators.

When the program locates the files, they can be viewed without launching the native application. InTEXT's links to the supported word processors are excellent. Within Microsoft Word, for instance, toolbar buttons and macros let you file, index, or summarize the active document without having to leave the application.



ORGANIZE AND FIND: *InTEXT summarizes documents, highlights abstract information, and allows searches.*

Summarizing documents is a good way to highlight the salient portions. You can set the length of the summary, view the highlights in context, search on and display any of its keywords, and print or copy the results to the Clipboard—although you can't save these summaries as separate documents.

InTEXT's biggest shortcoming is its prodigious space demands. Because it creates copies of the filed documents, our evaluation cabinet of 25 documents took up nearly 4MB of disk space—to store and index what had originally been just 200K of files. And InTEXT limits its searches to a maximum of ten cabinets. As a document-management system, InTEXT lacks some crucial components, such as OCR input, automated person-to-person routing, and integrated links to e-mail packages.

Overall, however, we found that InTEXT, with its SmartFolders and summary skills, is a credible text-retrieval application for both workgroups and single users.

▶ **Island InTEXT for Windows, Version 1.0.** List price: *$399 (introductory price through February 1995, $199).* Requires: *4MB RAM, 20MB hard disk space, Microsoft Windows 3.1 or later.* Island Software, *Novato, CA; 800-255-4499, 415-884-4400; fax, 415-884-4500.*

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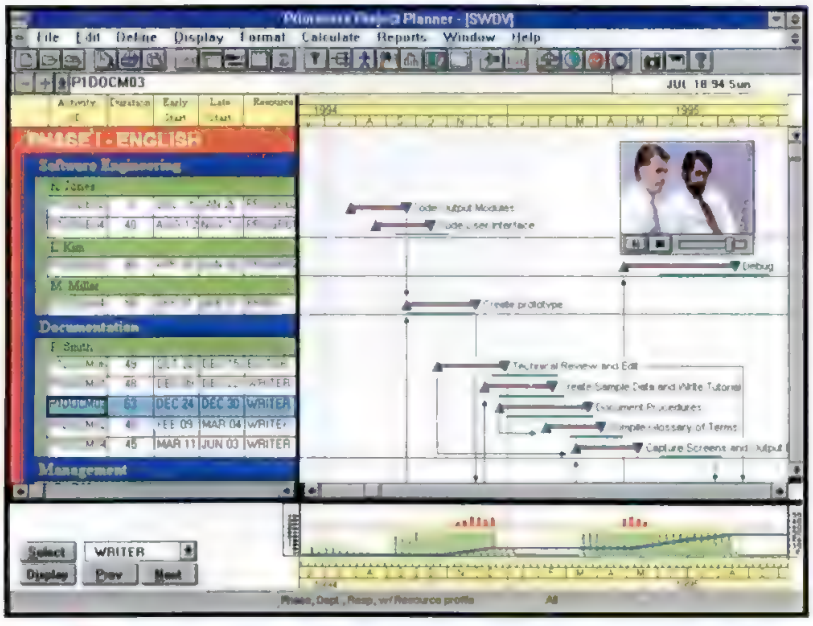

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■ Windows Graphics

3D Studio Retains the Lead In 3-D Illustration

BY JEFF PROSISE

Multimedia is all the rage these days, and whether it is for a training film, a sales presentation, or just the most elaborate screen-saver program, good multimedia requires quality 3-D graphics. And when it comes to producing 3-D special effects and realistic images, AutoDesk's 3D Studio, Release 4, delivers.

One of the last great DOS programs, 3D Studio may at first seem awkward to Windows users. But the package more than makes up for this with an exceptionally powerful and flexible interface. Indeed, 3D Studio is limited only by your imagination. Yet with a price of $2,995 and the need for extensive training and experimentation, this program may not appeal to all.

SURFACE: *3D Studio's Materials Editor allows near-infinite control over an object's material properites, such as surface texture and pattern.*

FIVE EASY MODULES

3D Studio is comprised of five tightly integrated modules: the 3D Editor, the 3D Lofter, the 2D Shaper, the Keyframer, and the Materials Editor. These modules support a variety of geometric transformations ranging from simple surfaces and extrusions to complex twists, deformations, and shapes.

After a little self-training, we found it easy to compose images in the 3D Editor by placing objects, lights, and cameras throughout a scene. Objects can be assembled from primitives that are provided by the 3D Editor or built from scratch with the 2D Shaper and 3D Lofter. In addition, 3D Studio adds Boolean operators to combine objects for complicated geometries; this feature is lacking on most 3-D modeling programs available today.

Most of the features

■ Windows Graphics

Simply 3D: Your Low-Price Ticket to the Third Dimension

BY DANIEL GROTTA & SALLY WIENER GROTTA

Now that high-powered PCs have brought real-time three-dimensional modeling to the desktop, there will likely be a flood of inexpensive software that can turn run-of-the-mill two-dimensional drawings and text into elaborate eye-popping 3-D graphics. Visual Software's $59 Simply 3D is aimed at 3-D amateurs who want to add special effects and depth to illustrations and presentations.

While it doesn't pack as many features as the company's $595 Visual Reality or AutoDesk's $3,000 3D Studio, many graphics professionals will still be impressed by Simply 3D. The downside is that the program offers so many modeling possibilities, many newcomers to the third dimension may get lost.

A LITTLE SCARY: *Simply 3D's elaborate interface can intimidate the novice.*

Simply 3D is composed of several connected programs that form a full 3-D toolbox. Renderize Live EZ does the actual 3-D rendering from a 2-D image or text file, while Visual Font can bevel, skew, and extrude TrueType characters. Visual Software also provides Autodesk's Animator, Microsoft's Media Player, and its own Visual Player, as well as a half-hour multimedia presentation and an 80MB collection of 70 textures and 100 3-D objects.

Program installation from the CD-ROM is simple and foolproof. We found that for maximum performance, we had to set up a 25MB permanent swap file and that nothing but DOS could be loaded into high memory. These parameters are outlined in the documentation.

Building 3-D effects starts with importing a 2-D file. The file can then be viewed as a wireframe model, and the user can select the details for the image: depth, camera angle, and lighting, to name a few. Actual 3-D rendering is relatively fast; performance depends on your PC's processor and the amount of system memory, and there's a faster low-resolution preview option. The 3-D images Simply 3D creates are as good as those produced by more expensive programs. Renderize Live EZ builds animation projects by assigning keyframes and selecting beginning and ending ranges. It then saves the file in .AVI, .FLC, or .FLI format.

Unfortunately, Simply 3D isn't very easy or intuitive to use, primarily because it suffers from an overabundance of tools and effects available to users. There are literally dozens of commands accessible from button bars, pull-down menus, and toolboxes that may delight the pro but will likely intimidate the 3-D novice. The documentation is comprehensive but not particularly easy to follow, and includes only a handful of illustrated examples.

Overall, however, Simply 3D is a powerful program that's certainly worth its $59 price tag.

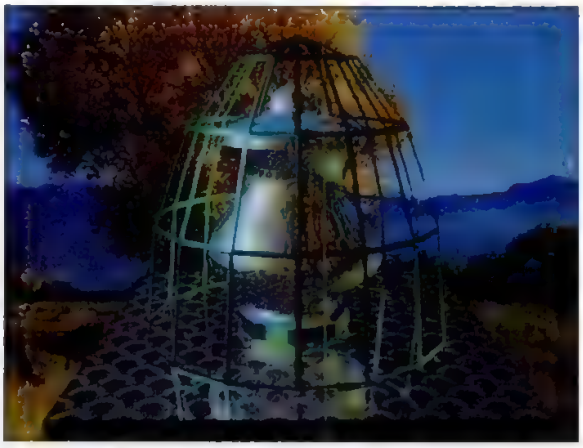
▶ **Simply 3D.** List price: *$59.* Requires: *8MB RAM (12MB recommended), 5MB hard disk space (60MB for full installation), CD-ROM drive, Microsoft Windows 3.1 or later.* Visual Software Inc., *Woodland Hills, CA; 800-881-4108, 818-883-7900; fax, 818-593-3750.*

Circle 416 on reader service card

new to 3D Studio are in the form of IPAS plug-ins. With a richer interface, these plug-in modules may now, for example, execute hold-and-fetch operations and access the z-buffer to add depth-of-field effects. In addition, there are more than 200 third-party plug-in products available, offering such diverse functions as ray tracing, fractal texturing, and particle system animation; hundreds more are on the way.

In our testing, we found that the most useful plug-in included with the product was the one for inverse kinematics. This feature converts hierarchically linked objects into animation chains (allowing us, for example, to animate a robot's arm to move in concert with its hand). The result is a tremendous amount of freedom of movement and motion.

Another new IPAS plug-in, the keyframe scripting language, enhances the Keyframer with a BASIC-like programming language called Keyscript. In addition, the fast preview plug-in speeds the creation of animation previews in the Keyframer, while the .EPS output plug-in adds encapsulated PostScript support to 3D Studio's repertoire of image formats. Finally, the camera control and match perspective plug-in is perfect for fine-tuning the viewing position.



REFLECTION: *Flat-mirror reflection feature mapping in 3D Studio allows the image of the vase to appear in the tabletop's reflection.*

PREVIEW YOUR EFFECTS

AutoDesk's 3D Studio provides nearly unlimited control over an object's appearance, color, shininess, texture, and so on. When assigning properties to an object, you can choose from hundreds of built-in materials and finishes supplied on-disk or you can create your own with the Materials Editor. We found that the interactive nature of the Materials Editor made it an excellent way to view effects as we created them.

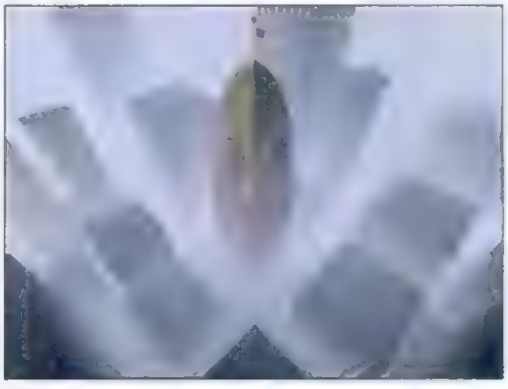
Any 3-D renderer worth its salt must support texture mapping, which can create realistic finishes—such as wood grain or roughness—by treating a 2-D bitmapped image like a piece of paper wrapped around a 3-D object. 3D Studio can texture map with virtually any bitmapped image format. But the program goes way beyond simple texture mapping with its bump mapping and reflection mapping capabilities. Bump mapping, for example, manipulates the intensity of pixels in a bitmapped image to vary the angles at which light is reflected off a surface. This effect creates an illusion of surface roughness. Reflection mapping simulates the shiny quality of chrome, glass, and polished surfaces by drawing in reflections of other objects.

Once the surface was established, we found tremendous flexibility in applying 3D Studio's three standard shading functions: flat, gouraud, and phong. In addition, the program provides a special form of smooth shading called *metal shading*, which is ideal for simulating metallic surfaces.

Scenes can be illuminated with ambient light, omnidirectional lights, and spotlights. A click of a button was all that was needed to create shadows, and you can choose between soft drop shadows or crisply drawn ray-traced shadows.

Once the objects in a scene are prepared, the animation sequence is staged in the Keyframer by assigning what AutoDesk calls keys. A key is a description of an object's position, orientation, and other spatial properties at a particular point in the animation. When keys are separated by one or more frames, 3D Studio automatically creates the in-between frames—or *tweens*, as the program refers to them—that create a smooth transition. Special morphing keys facilitate the transformation of one object into another.

The program's Keyframer supports a wide variety of special effects designed to add a realistic edge. With 3D Studio's keys, you can easily vary an object's speed to simulate, for example, the acceleration of gravity. You can even place mechanical constraints on one object's motion relative to another object.



TEXTURE: *3D Studio's texture mapping allows an illustration to be a combination of several overlapping effects.*

VIDEO CONNECTION

If creating special effects is your specialty, 3D Studio has everything you're likely to need. A small sampling of its special effects capabilities includes projector lighting (which allows spotlights to cast still or moving images), distance cueing and fog (for atmospheric effects), and wave generators (for surface-rippling effects). 3D Studio also includes a Video Post module for such post-processing tasks as compositing images and creating scene-to-scene transitions.

The sum of all this is a sophisticated, highly interactive 3-D rendering engine that leaves no stone unturned in building a comprehensive tool for creating realistic 3-D images and animation. 3D Studio is used extensively for game development, architectural previews and walk-throughs of digital buildings, forensic and courtroom animation, and motion picture production—and will continue to be the standard by which other 3-D programs are judged.

The documentation accompanying 3D Studio, Release 4, is superb. The five paperback manuals (an installation guide, user guide, reference manual, tutorials guide, and new features guide) provide a running start for learning the program. It's never easy learning the details of a product as complex as this one, but Autodesk makes the process as pleasurable as possible—proof that not all software manufacturers save the documentation for last.

There might be an easier way to create photorealistic 3-D productions on a PC, but if there is, we've yet to see it.

▶ **3D Studio, Release 4.** List price: *$2,995; upgrade from Release 3, $295.* Requires: *8MB RAM, 20MB hard disk space.* Autodesk Inc., *Sausalito, CA; 800-879-4233, 415-332-2344; fax, 415-491-8303.*

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Jack Webb

■ Networking

LANtastic Brings Peer-to-Peer Networking to OS/2

BY STEVE RIGNEY

For networking together OS/2-based PCs, IBM's LAN Server has been the only game in town. Enter Artisoft's LANtastic for OS/2, which—like the company's DOS- and Windows-based LANtastic 6.0—provides an easy-to-understand graphical interface and strong security and management features, but adds comprehensive connectivity to a variety of platforms.

LANtastic for OS/2 plays the number game; it is basically LANtastic 6.0 ported to run on OS/2. That means it can take advantage of the operating system's 32-bit multitasking abilities. Priced at $139 per node, LANtastic for OS/2 works well within OS/2, taking advantage of its file system, its Presentation Manager interface, and its ability to handle long filenames. While LANtastic for OS/2 provides all of the file and printer sharing, security, and management features that are present in LANtastic 6.0, we found that the OS/2 version does not include Artisoft's Exchange Windows groupware programs for network e-mail and group scheduling.

POPULATE: *LANtastic for OS/2's Network Manager allows you to add new resources to your network and define rights.*

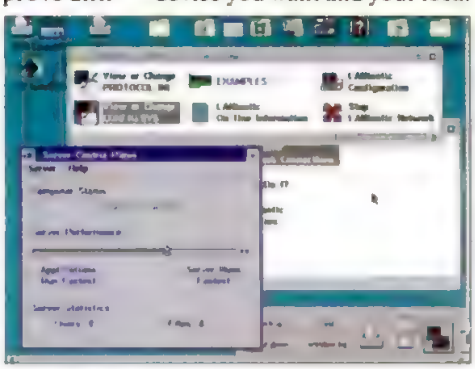
THE UNIVERSAL CLIENT

In the eyes of a network administrator, the most exciting part of LANtastic for OS/2 is the universal network client. The peer-to-peer networking program comes with all of the software needed to connect clients to OS/2 and DOS-based servers—using LANtastic's NetBIOS protocol—and to Windows servers (including Windows for Workgroups and Windows NT) using the Server Message Block (SMB) protocol. You can also use the SMB protocol to communicate with servers running IBM's LAN Server. Unlike LANtastic 6.0, however, the OS/2-based product does not work with NetWare servers running on NCP (NetWare Core Protocol) software, but it does work with Novell's NetWare requester for OS/2, although configuration may prove difficult.

LANtastic for OS/2 does not currently support SMB Domain Names. The fallout is that you will have to know the names of all of the network SMB servers in order for the client to find the server. While just a minor annoyance when setting up a small network, we found this missing link to be awkward and time-consuming when setting up and configuring multiple servers.

In our tests, we used LANtastic for OS/2 and the NetWare requester to connect our client running OS/2 Warp, Version 3.0, to a NetWare 3.12 server, a DOS-based LANtastic 6.0 server, a Windows for Workgroups 3.11 server, and a Windows NT 3.5 server. We found LANtastic for OS/2 extremely easy to install and use over a wide range of equipment and network operating systems. The only major problem we encountered was with configuring a preexisting NetWare requester; we had to remove the NetWare requester and reinstall LANtastic. Fortunately, the user manual explains how to do this.

Because LANtastic for OS/2 uses the OS/2 Presentation Manager graphical interface, the program is easy to navigate. For example, if you want to connect to a network printer, you simply select the device you want and your local port and click the Connect button. You can also use the Net Manager program in order to perform server administration tasks, such as adding new shared resources and increasing your network cache buffers to balance system performance.



STREAMLINE: *You can use the Server Control Panel to balance performance between local application speed and network tasks.*

DATA LINK

A useful feature that is carried over from LANtastic 6.0 is network DDE, which allows network clients to share data over the network. Network DDE allows two or more users simultaneously to link information into a single Windows or OS/2 application and make changes to those objects on the fly. For example, we were able to connect an Excel spreadsheet on one system to a Word document on another; any changes made were automatically updated on the other PC. While simple and straightforward, this ability to work on documents simultaneously across a variety of platforms and applications has the power to streamline a business.

Like its DOS counterpart, LANtastic for OS/2 provides excellent security features. The operating system supports file-level access for all of your network data. Other peer-to-peer networks such as Windows for Workgroups provide security only at the drive or directory level. You can also control access to your OS/2 LANtastic servers based on username, password, the time of day, and the day of week. The LANtastic ACL (Access Control List) Groups allow you to limit the types of access to individual files and directories. For example, certain users can be allowed to change or create files in a subdirectory, while other users can only view the material.

LANtastic for OS/2 is a big step forward, and allows network administrators to consider OS/2 as a viable networked desktop operating system.

► **LANtastic for OS/2.** List price: *$139 per node; 5-user license, $629; 10-user license, $1,119.* Requires: *4MB RAM, 3MB hard disk space, OS/2 2.1 or later.* Artisoft Inc., *Tucson, Arizona; 800-233-5564, 602-670-7100, fax 602-670-7101.*

Circle 419 on reader service card

Business CD-ROMs

A CD-ROM for Serious Scientific Exploration

BY BARRY BRENESAL

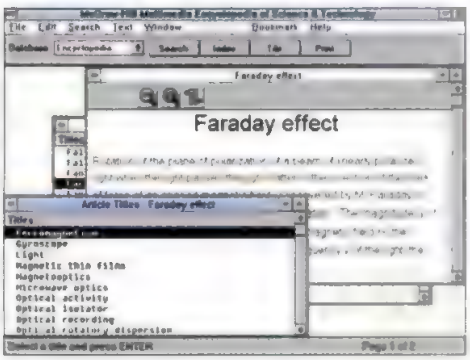
Most multimedia encyclopedias are intended as learning experiences first and reference guides second. This is not the case, however, with the McGraw-Hill Multimedia Encyclopedia of Science & Technology. The $1,300 package is a sober, rich guide for serious research and exploration.

This CD-ROM encyclopedia really comes into its own when the information you need is specialized in nature. Abscisic acid, for instance, rates an article of more than 1,400 words. That's 1,400 words more than any of the general-interest CD-ROM encyclopedias devote to the subject. A large percentage of McGraw-Hill's 7,300 articles and 122,600 definitions are devoted to similarly recondite scientific themes; you'll also find information here on more general scientific concepts.

While the information may be esoteric, accessing it couldn't be easier. The program quickly processes keyword, Boolean, and hypertext searches; buttons on the toolbar let you call up a list of articles related to the topic you're currently viewing, or examine a series of related article subheadings. You can simultaneously peruse and print as many of the encyclopedia's articles and illustrations as your Windows memory permits. Science & Technology is also very application-cooperative. It has no objections to being shunted aside while you examine a spreadsheet, fix an advertising layout, or e-mail messages.

When it comes to multimedia effects, however, the current crop of general-interest encyclopedias win hands down. Science & Technology's brief animated sequences are generally poor and don't portray any additional information. For the most part, they're too short to make any point and too small to show any detail. The visually crude illustrations encounter the opposite shortcoming. They're drawn full-screen, and won't shrink-to-fit. Voice-overs are muffled, noisy, and hard to understand. And although McGraw-Hill permits you to set a default font and size, it does not use scalable fonts, so on-screen reading can be difficult at times.

While it's only adequate for recreational use, the McGraw-Hill Multimedia Encyclopedia of Science & Technology really shines when the questions you're asking can't be answered by a multimedia Mr. Wizard CD. As a computerized reference tool for in-depth scientific knowledge, it is unsurpassed.



NO FRILLS: *McGraw-Hill's take on technology includes just the facts and lacks dazzling multimedia effects.*

▶ **McGraw-Hill Multimedia Encyclopedia of Science & Technology.** List price: *$1,300.* Requires: *4MB RAM, 1.2MB hard disk space, CD-ROM drive, Microsoft Windows 3.1 or later.* McGraw-Hill Inc., *New York, NY; 800-722-4726; fax, 614-755-5645.*

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Windows Utilities

Remove-IT Once and for All

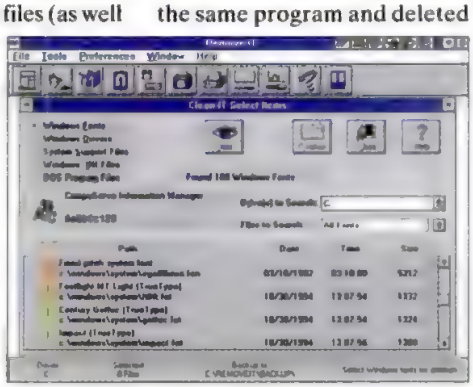
BY LENNY BAILES

Vertisoft Systems' Remove-IT is one of those *gotta* have utilities that can safely and conveniently purge the leftovers of old programs. Remove-IT cleans up Program Manager groups, Windows .INI files, and hard disk directories of unwanted applications, making this $69.95 program the most complete Windows uninstaller available.

In addition to searching program headers for associations to .DLL files and .INI files (as well as auxiliary programs), Remove-IT includes a pair of watchdog TSR programs: Log-IT keeps track of new applications, while Watch-IT measures DOS and Windows usage frequency. The Watch-IT utility displays a pie-chart graph of application and driver usage, letting you single out dead-weight files from your disk. On the downside, we found that Watch-IT is incompatible with Windows for WorkGroups' 32-bit file-access feature.

Once you know what to throw away, Remove-IT's deletion module can erase, compress, or archive any application to a backup directory. We found that the program did a splendid job of deleting programs, but archiving Microsoft Access, which comprised 8MB of files, took about 45 minutes.

We found that Remove-IT could tell the difference between different versions of the same program and deleted only those files linked to the version being removed. Shared .DLLs and WIN.INI-associated documents are recognized and assigned a yellow warning flag; those elements used by other applications get a red flag. To help you make a decision about the yellow-flagged files, the link button displays all the .DLLs and programs in the search path that refer to or are referenced by the file you want to purge.



WARNINGS: *Remove-IT's listing of individual items shows a yellow or red warning flag for those things you might regret deleting.*

As thorough as it is, we found that when we removed PageMaker 4.0, Remove-IT missed the Table Editor icon, although everything in the PM4 directory was removed from the disk. When purging Corel Ventura 4.2, we found that the corresponding entry in WIN.INI remained. On the plus side, Remove-IT's emergency recovery disk can help you get back on your computing feet again should disaster ever strike. Like the Norton Utilities, it preserves partition information and DOS and Windows system files.

If programs come and go on your system and you're looking for more hard disk space, Remove-It can recover what previous applications took away.

▶ **Remove-IT.** List price: *$69.95.* Requires: *2MB RAM, 2MB hard disk space, Microsoft Windows 3.1 or later.* Vertisoft Systems Inc., *San Francisco, CA; 800-466-5875, 415-956-5999; fax, 800-466-4719.*

Circle 422 on reader service card

Windows Utilities

just Buttons Makes Your Mouse Roar

BY BARRY SIMON

By supercharging your mouse, Chrisalan Designs' just Buttons can transform the way you use your PC. This $39 program allows you to assign a range of tasks to your mouse buttons, which can save time and keystrokes.

In order to edit or create a just Buttons script, all you do is choose which mouse button you wish to enhance, and click on Button Setup. The dialog box that appears takes you step-by-step through the process; there are 17 different types of actions from which to choose. You can also customize each action in a script.

just Buttons can handle everything from the trivial to the complex. Actions such as launching File Manager or a Control Panel are easy to set up; you can even get fancy if you want, launching File Manager with specific directories opened. But when you need the functions that are associated with programming languages, just Buttons presents a huge leap forward.

just Buttons also includes a variety of functions to manipulate text and variables. Unfortunately, the dialog boxes tend to be nothing more than multiline edit windows where you type in code with minimal assistance from the program. And some actions—such as choosing a menu item in another application—are only accessible via commands that you must manually type into a Control Script edit box.

Included in the just Buttons program is a powerful scheduler that can automatically start scripts. Because a scheduled item can run a script, it can test the many system variables that just Buttons tracks and react accordingly. For example, when the program senses low system resources, it closes nonessential applications.

A first effort, just Buttons is missing many of the elements that you might expect to find in such a scripting product. There is no DDE support or ability to drive other programs via OLE automation. Moreover, there is no dialog box editor, so data can only be input via specific kinds of dialog boxes.

The product is very much one that is rapidly evolving. The documentation for just Buttons looks like an on-line help section. A powerful Command Line Plus item was recently added in the version that we reviewed (allowing you to search for a running application). It worked quite well, but was not covered in the program's documentation. Fortunately, the new function's dialog box structure was coherent enough to guide the curious user. On the other hand, the on-line help function list includes many items with blank sections—indicating that the developers are planning greater support in future versions of the program.

SCRIPTING LANGUAGE: *By clicking on choices from just Buttons' Function List, you can include sequences of functions.*

Overall, just Buttons is currently in a form that requires a sophisticated user—and one who is willing to invest a little time to get the most out of this unique product. The program represents an exciting peek into the future of Windows application automation.

▶ **just Buttons, Version 1.03h.** List price: *$39.* Requires: *4MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later.* Chrisalan Designs Inc., *Wenatchee, WA; 509-663-7770; fax, 509-662-5948.*

Circle 428 on readers service card

Windows Utilities

WinBatch: More Windows Power and Versatility

BY J.W. OLSEN

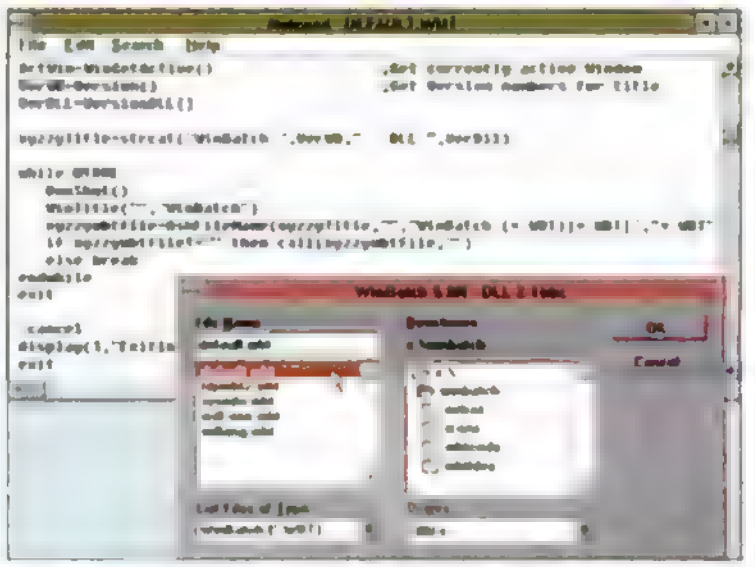
When we reviewed Version 4.0 of WinBatch last February, we found several weaknesses that tended to detract from an otherwise good product. With Version 5.0 of its compiler, Wilson WindowWare not only addresses most of these concerns, but also adds a lot to the product. Whether you simply want to schedule unattended operations or automate complex movement and conversion of data between applications, WinBatch is ready.

We reviewed the $395 16-bit WinBatch Compiler. Available for $495 is WinBatch Compiler 32 for Microsoft Windows NT. Each program includes an interpreter that can also be purchased seperately—for $69.95 and $99.95, respectively.

The most obvious improvements include the reduced size and increased execution speed of scripts. More importantly, however, WinBatch now encourages a more structured programming style, so programmers of few words are rewarded with efficient fast-running scripts. Dialog boxes and scrollable lists now permit multiple selections. And more than 200 improved functions allow for better control.

WinBatch scripts can now call any third-party DLL. Another new feature allows you to send menu selections (in addition to keystrokes) to applications or to MDI child windows within applications. Of particular note for those who cross over between DOS and Windows: When executing DOS tasks within Windows, WinBatch can manipulate the DOS environment.

A 375-page manual, with tutorial and reference sections, is the final ingredient that makes WinBatch Compiler, Version 5.0, a powerful tool.



BEFORE AND AFTER: *WinBatch 5.0 expands its features while maintaining economical use of English syntax.*

▶ **WinBatch Compiler.** List price: *$395.* Requires: *4MB RAM, 1MB hard disk space, Windows 3.1 or later.* Wilson WindowWare Inc., *Seattle, WA; 800-938-4590, 206-938-1740; fax, 206-935-7129.*

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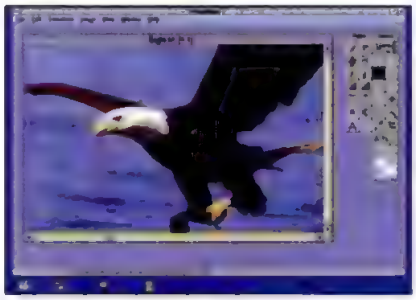

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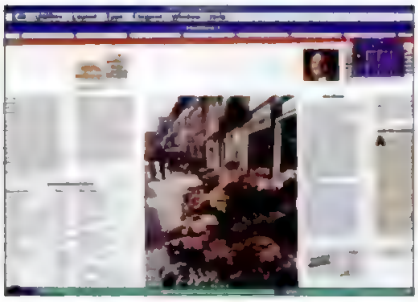

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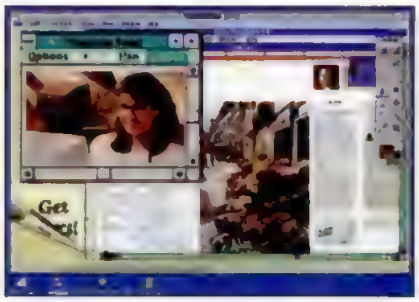

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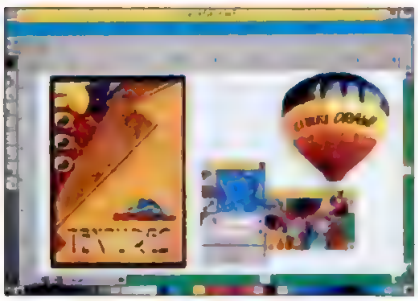

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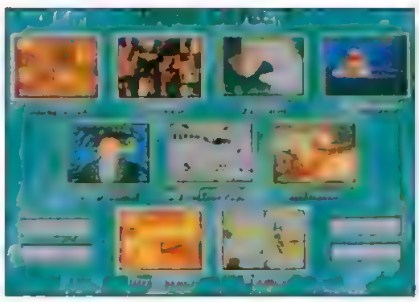

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■ Charting

allClear Turns English into Charts

BY DAVID HASKIN

For better *and* for worse, allClear for Windows has long stood out in the crowded field of flowcharting software. It was unique because it required the use of its script language to create charts, which increased the steepness of its learning curve, but ensured the accuracy and precision of the charts produced.

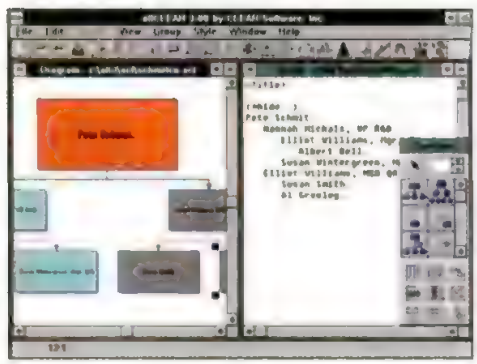
allClear III for Windows keeps the script language but adds drag-and-drop chart creation and the ability to move from script mode to graphics mode at will. The result is a $299 program that is rigorous (it checks for errors such as unfinished processes) but easy to use (users can create complex charts by starting with an outline).

The first step is to pick a type of chart: decision, fishbone, process, or tree. You also can load one of 25 chart templates and fill in the details. At all times, allClear displays two windows: one containing the chart in progress, the other the associated script. As you change one window, the other is updated, giving you instantaneous feedback. In a manner similar to programs such as Shapeware's Visio, you can drag shapes from the palette and drop them in the chart creation window.

While the script language—with its 21 commands—is simple to learn, most users may find it easier to begin with an outline, where indentations determine different levels and shapes. Click on the chart window after editing a script and allClear applies the script changes to the chart or tells you if there are any major errors. Using the chart window's dialog box, we found it easy to change formatting attributes such as background colors, fonts, and line weights.

A couple of areas still need work. Most notably, error messages are vague. Also, we found it quite cumbersome to move individual shapes around on a chart, making it difficult, for example, to update a chart.

Still, allClear III succeeds because it offers the best of two worlds: It is simple enough for casual users who want to build charts from a written outline, yet it provides the precision that is needed when accuracy is critical.



YOUR CHOICE: *AllClear III is flexible enough to let you create a chart via a script or drag-and-drop—or both.*

▶ **allClear III for Windows.** List price: *$299.* Requires: *4MB RAM, 5MB hard disk space, Microsoft Windows 3.1 or later.* Clear Software Inc., *Newton, MA; 800-338-1759, 617-965-6755; fax, 617-965-5310.*

Circle 429 on reader service card

FIRST LOOKS PLUS

From January 3 through 6, you can go on-line to download a working demo of allClear III for Windows or to discuss the product with reviewer David Haskin and Vadim Yasinovsky, president of Clear Software Inc. Type GO EXEC at any CompuServe ! prompt.

■ Illustration

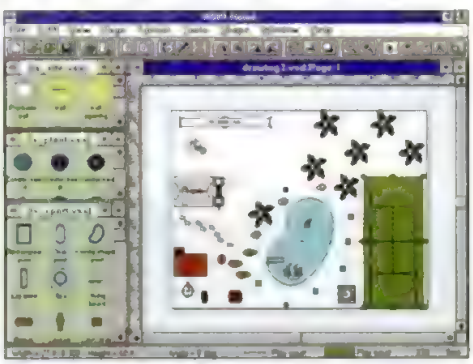
Visio: At Home at the Office

BY MELISSA J. PERENSON

It's rare when a software package appeals to both children and adults, but Shapeware's $79 Visio Home 3.0 does just that. And although Visio Home won't do greeting cards or room and landscape design as well as more specialized programs, it is a flexible program that can create everything from street maps to organization charts to chemistry diagrams.

A useful and fun-to-use tool, Visio Home may be considered a standalone complement to Shapeware's all-business Visio 3.0. As both programs share Visio's interface and drawing engine, you can intermix stencils between the products. Visio Home is packed with a wealth of design options you'd expect to find in desktop publishing and graphics packages; yet, if you prefer, you can easily bypass these features and still create detailed illustrations.

Simplicity is key here: With its system of stencils, templates, and drag-and-drop graphics, Visio Home will jump-start any drawing locked up in your imagination. Visio Home includes more than 30 stencils (electronic incarnations of the green plastic drawing templates). The stencils feature 900 images, objects, and shapes you can drag-and-drop anywhere within your document. Sizing is accomplished by clicking on the object's corner and stretching it.



RUNAWAY IMAGINATION: *With Visio Home's drag-and-drop graphics, you can create your dream backyard.*

To further simplify things, you can select from a gallery of 26 document template icons—including block diagrams, family trees, flash cards, tournament charts, treasure maps, and world maps. Selecting a template will open both a gridlike page and the related stencils.

The flexibility built into Visio Home gives you the option of opening any stencil while working on any template, so you can place a dinosaur on your invitation's street map or add a treasure chest to your organization chart. Further, you can import most graphics formats to create your own templates. There's a helpful 4-minute guided tour of the program, and the included documentation is clear and concise.

We had only one qualm with the program: While the graphics maintain a sense of individual proportionality, it would help if there was an option to automatically size objects relative to others—so that a tree, for example, doesn't overwhelm the building it is next to.

Visio Home 3.0 is a required purchase for those seeking to promote both creativity and productivity.

▶ **Visio Home 3.0.** List price: *$79.* Requires: *4MB RAM, 5MB hard disk space, Microsoft Windows 3.1 or later.* Shapeware Corp., *Seattle, WA; 800-446-3335, 206-521-4500; fax, 206-521-4501.*

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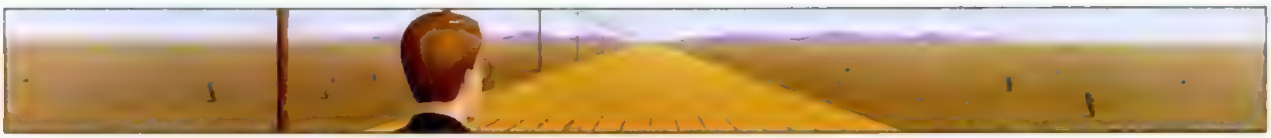

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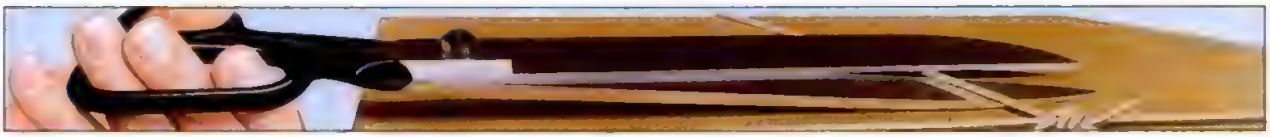

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03064

Windows Utilities

Do It by the Numbers with PROcalc

BY J.W. OLSEN

JASC's PROcalc strives to fill the void left by the minimalist Windows calculator applet. Though PROcalc's range of functions won't satisfy accountants, it does meet everyday needs for a reasonable $30.

PROcalc is two-faced. A full-display mode provides access to all of the program's functions, including a mouse-accessible numeric keypad and displays of financial registers, memory, and constants. With one mouse click you can switch to a smaller display of basic functions that's easier to manipulate when superimposed over another application. Data can be pasted between PROcalc and other applications via the Windows Clipboard.

Extensive mathematical and financial calculations include markup and markdown, squares and square roots, and simple and compound interest. Particularly handy is the ability to store and retrieve tallies, which mimic printed adding machine tapes.

Creating macros for frequent calculations, such as sales tax, is a breeze. Unfortunately, you are limited to only five storable macros. Another first-release weakness involves display oddities when invoking child windows (such as when creating macros). Some areas of the main window can overwrite the child window.

PROcalc is available as a shareware program, so you can evaluate it before purchase. You'll find powerful functions and a delightfully intuitive interface for an attractive price.

▶ **PROcalc.** List price: *$30.* Requires: *4MB RAM, 1MB hard disk space, Microsoft Windows 3.1 or later.* JASC Inc., *Minnetonka, MN; 800-622-2793, 612-930-9171; fax, 612-930-9172.*

Circle 425 on reader service card

DO IT YOUR WAY: *PROcalc's two different user interfaces are handy when doing calculations over other applications.*

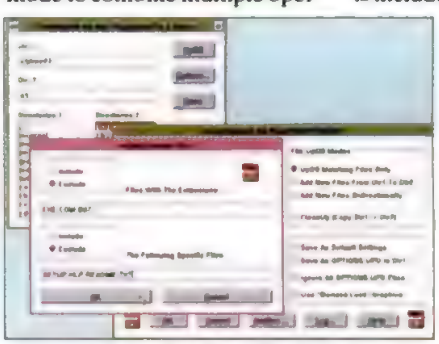
Windows Utilities

PRO-Up Keeps Data in Synch

BY J.W. OLSEN

Open Windows' $49.95 PRO-UpD8R 4.0 package is a useful though somewhat limited tool for synchronizing files spread across a network.

After installing PRO-UpD8R on all PCs that are either the source or destination of data, you define operations, which is similar to setting up a backup program. Files can be marked to be copied or to be excluded. For example, we set PRO-UpD8R to synchronize the ACCESS\TIMELOG directory with the ACCESS\TIMELOG\ADMIN file on a different server. We could just as easily have used the product to synchronize a file and its subdirectories, or only the subdirectories. PRO-UpD8R offers a batch mode to combine multiple operations, and it can also update only newer versions of existing files.



DECISIONS, DECISIONS: *PRO-UpD8R provides many transfer options to synchronize files and directories.*

Documentation of some of the options is weak, and PRO-UpD8R can only move files between uncabled PCs on a floppy disk or other removeable data media; no data compression is included.

Given the program's limitations, PRO-UpD8R may be best suited for experienced users and LAN administrators looking to fill a specific data-transfer need.

▶ **PRO-UpD8R 4.0.** List price: *$49.95.* Requires: *4MB RAM, Microsoft Windows 3.1 or later.* Open Windows, *Colorado Springs, CO; 800-531-0403, 719-531-0403; fax, 800-531-0403.*

Circle 427 on reader service card

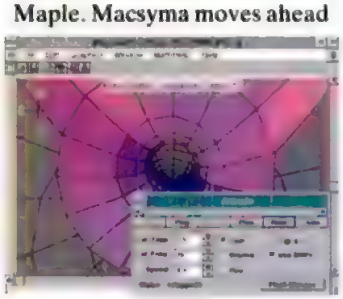
Scientific Software

Animate Your Equations with Macsyma

BY BARRY SIMON

While the $299 Macsyma 2.0 symbolic math program's flashiest new feature is full fledged graphics animation, what users will appreciate most are its increased speed and formatting flexibility.

Macsyma contains a rich variety of mathematical equations, including more than 180 new matrix functions. Its main competitors are Wolfram Research's Mathematica and Waterloo Maple Software's Maple. Macsyma moves ahead by adding the ability to change fonts on a character by character basis rather than on a per paragraph basis, and it also allows you to animate a graphical function. This gives the user the ability to view the way the graph will change over time or as another variable is changed.



ACTION: *Macsyma's animation module brings complex mathematical equations to life.*

Speed is where Macsyma excels, especially in terms of numeric matrix handling. But this comes at a cost because Macsyma demands substantial system resources. While the vendor says the program will run on an 8MB machine, you'll want the combination of RAM and swap file to be at least 26MB to run the program comfortably.

Having caught up in areas where it had been weak, Macsyma is now the leader in the mathematical program marketplace.

▶ **Macsyma 2.0.** List price: *$299.* Requires: *8MB RAM, 20MB hard disk space, Microsoft Windows 3.1 or later.* Macsyma Inc., *Arlington, MA; 800-622-7962, 617-646-4550; fax, 617-646-3161.*

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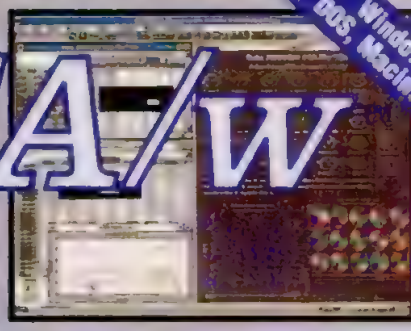
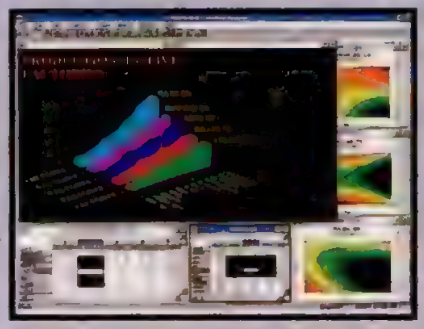
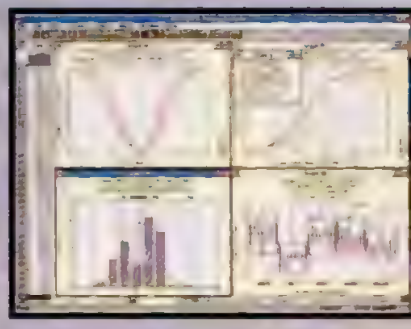
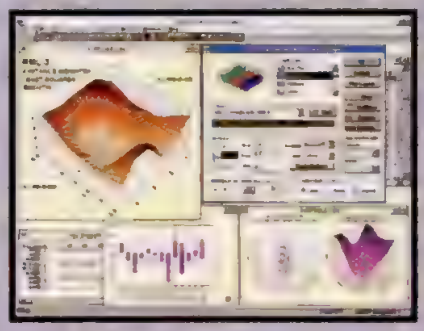
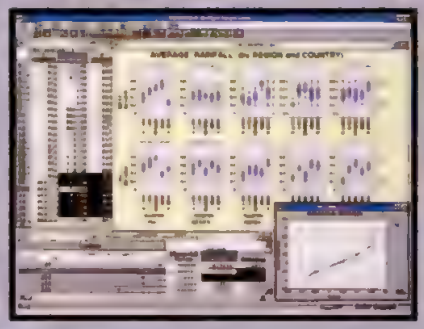
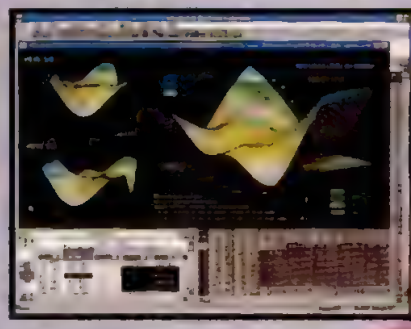
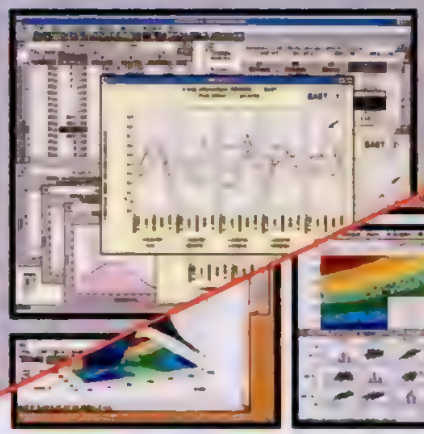
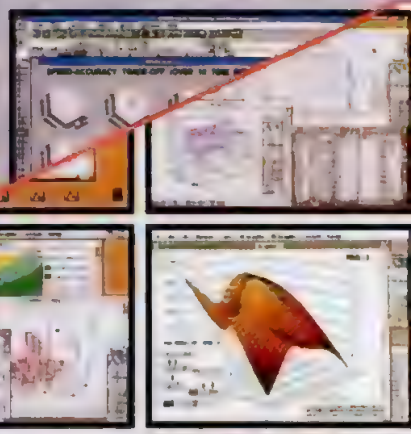
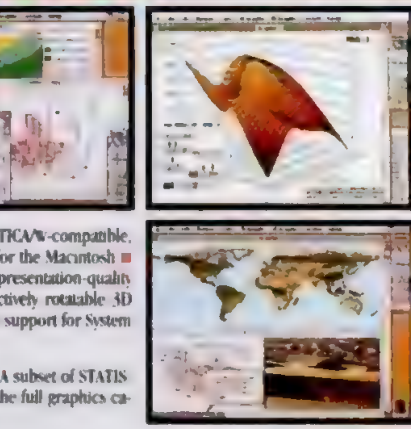
STATISTICA/w

Windows, DOS, Macintosh

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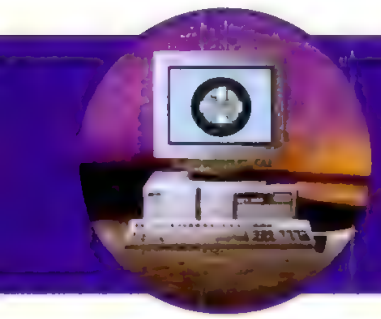
HP quality in value-priced PCs.

HP Vectra VL2



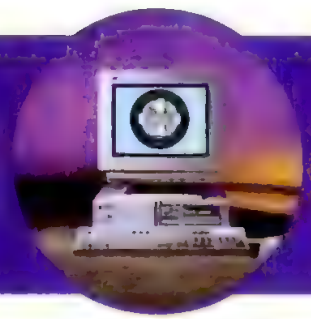
from

$1,119[1]

- *Intel 50-MHz 486SX2, 50- and 66-MHz 486DX2, 100-MHz DX4, upgradeable to Pentium™ Overdrive™ processor; Intel 60-MHz Pentium processor*
- *Chip upgrades to higher performance*
- *On-board accelerated local-bus video*
- *210-MB hard drive[1]*
- *4-MB RAM, expandable to 64-MB*
- *512 KB or 1 MB of Video RAM standard*
- *ISA Plug-n-Play compliant*
- *Desktop Power Management*
- *EPA Energy Star certified*
- *Local bus Fast-IDE hard disk interface***
- *1280 x 1024 video resolution***
- *Optional 128- or 256-KB cache memory***
- *Free three-year limited warranty for parts and labor[2]*

High-performance network-ready PCs in a slimline package.

HP Vectra N2



from

$1,459[1]

- *Intel 50-MHz 486SX2, 50- and 66-MHz 486DX2, upgradable to Pentium Overdrive processor*
- *Optional 128- or 256-KB second level cache*
- *270-MB, 14-ms Fast-IDE hard drive[1]*
- *32-bit Fast-IDE local-bus hard disk interface*
- *8-MB RAM, expandable to 96-MB*
- *Ultra VGA2 local-bus accelerated video supporting up to 1280 x 1024 resolution*
- *1 MB of video RAM standard, expandable to 2 MB*
- *Slimline package with two mass storage shelves and three ISA slots*
- *Optional integrated 10Base-T networking*
- *Multilevel security*
- *EPA Energy Star certified*
- *ISA Autoconfiguration utility (Plug-n-Play)*
- *Integrated Desktop Management Interface (DMI)[3]*
- *Free three-year limited warranty for parts and labor[2]*

High-performance PCs for the connected office.

HP Vectra M2

from

$1,509[1]

- *Intel 50-MHz 486SX2; 50- and 66-MHz 486DX2, 100-MHz DX4, upgradable to Pentium Overdrive processor*
- *Optional 128- or 256-KB second level cache*
- *Four mass storage shelves; four expansion slots*
- *One available 32-bit VL-bus slot*
- *270-MB, 14-ms Fast-IDE hard drive[1]*
- *32-bit Fast-IDE local-bus hard disk interface*
- *8-MB RAM, expandable to 96-MB*
- *Ultra VGA2 local-bus accelerated video supporting up to 1280 x 1024 resolution*
- *Optional integrated 10Base-T networking*
- *Systems Diagnostics Utility*
- *EPA Energy Star certified*
- *ISA Autoconfiguration utility (Plug-n-Play)*
- *Integrated Desktop Management Interface (DMI)[3]*
- *Free three-year limited warranty for parts and labor[2]*

Exceptional 486 performance for advanced business use.

HP Vectra XM2

from

$1,779[1]

- *Intel 50- and 66-MHz 486DX2, 100-MHz DX4, upgradable to Pentium Overdrive*
- *PCI architecture*
- *Standard 256-KB second level write-back cache*
- *Four mass storage shelves; four expansion slots*
- *Two available 32-bit PCI expansion slots*
- *210-MB, 14-ms Fast-IDE hard drive[1]*
- *32-bit PCI IDE hard disk interface*
- *8-MB RAM, expandable to 96-MB*
- *PCI Integrated 64-bit S3 Vision-864 graphics accelerator supporting up to 1280 x 1024 resolution*
- *Optional PCI Integrated 32-bit 10Base-T networking*
- *Integrated Desktop Management Interface (DMI)[3]*
- *EPA Energy Star certified*
- *Free three-year limited warranty for parts and labor[2]*

intel inside

*Source: 1994 J.D. Power and Associates Desktop PC Customer Satisfaction Study℠ Study conducted among business users and based on 1,528 user respondents.
**Feature included with some models. All HP Vectra PCs come with MS-DOS® 6.2 and MS Windows for Workgroups 3.11 pre-installed, HP mouse and keyboard included.
[1]U.S. list price, dealer prices may vary. Monitor not included. Other capacities available. [2]First year on-site, 24-hour service. Second and third year return to dealer.
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The ultimate PC for advanced business and technical applications.

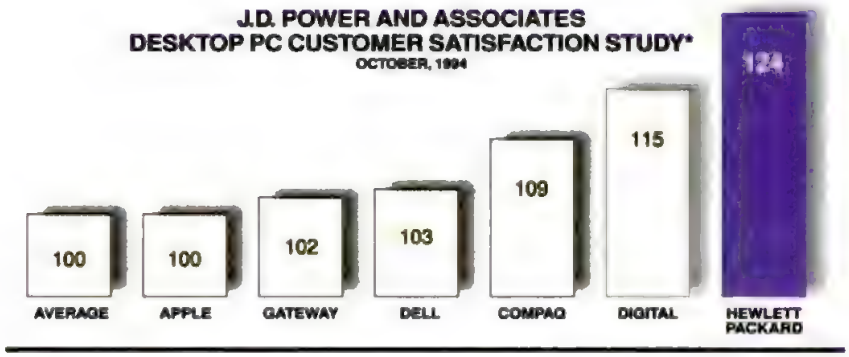
HP Vectra XU

from
$3,279'

- *Intel 90-MHz Pentium processor*
- *Second processor socket for MP Spec 1.1 multi-processing*
- *Standard 256-KB second level asynchronous or burst asynchronous write-back cache*
- *PCI architecture*
- *Four mass storage shelves (three front accessible); five expansion slots*
- *Two available 32-bit PCI expansion slots*
- *270-MB, 12-ms Fast SCSI-2 hard drive'*
- *Integrated 32-bit PCI SCSI-2 interface*
- *PCI integrated 64-bit S3 Vision-864 graphics with 1280 x 1024 resolution or PCI MGA Ultima Plus graphics with up to 1600 x 1200 resolution*
- *32-bit PCI IDE hard disk interface*
- *8 or 16 MB of RAM, expandable to 256 MB*
- *PCI Integrated 32-bit 10Base-T networking*
- *Integrated Desktop Management Interface (DMI)²*
- *Free three-year limited warranty for parts and labor³*

CUSTOMER SATISFACTION J.D. POWER AND ASSOCIATES PC USERS • 1994

No other PC can display this icon.



J.D. Power and Associates ranks HP highest in customer satisfaction among desktop personal computer business users.

Not to be boastful, but people are taking a lot more notice of HP PCs lately. After all, they're the only computers that carry the symbol of one of the most prestigious awards in the business. Fact is, in overall scoring HP outpaced every other vendor in the field.

Of course, HP PCs also lead the pack in value, with all the features you need, at prices you can afford.

For a copy of *The Power Report*℠ on the Desktop PC Study, or the name of the dealer nearest you, call us at 1-800-322-HPPC, Ext. 8998 today. And join the ranks of the most satisfied PC customers in America.

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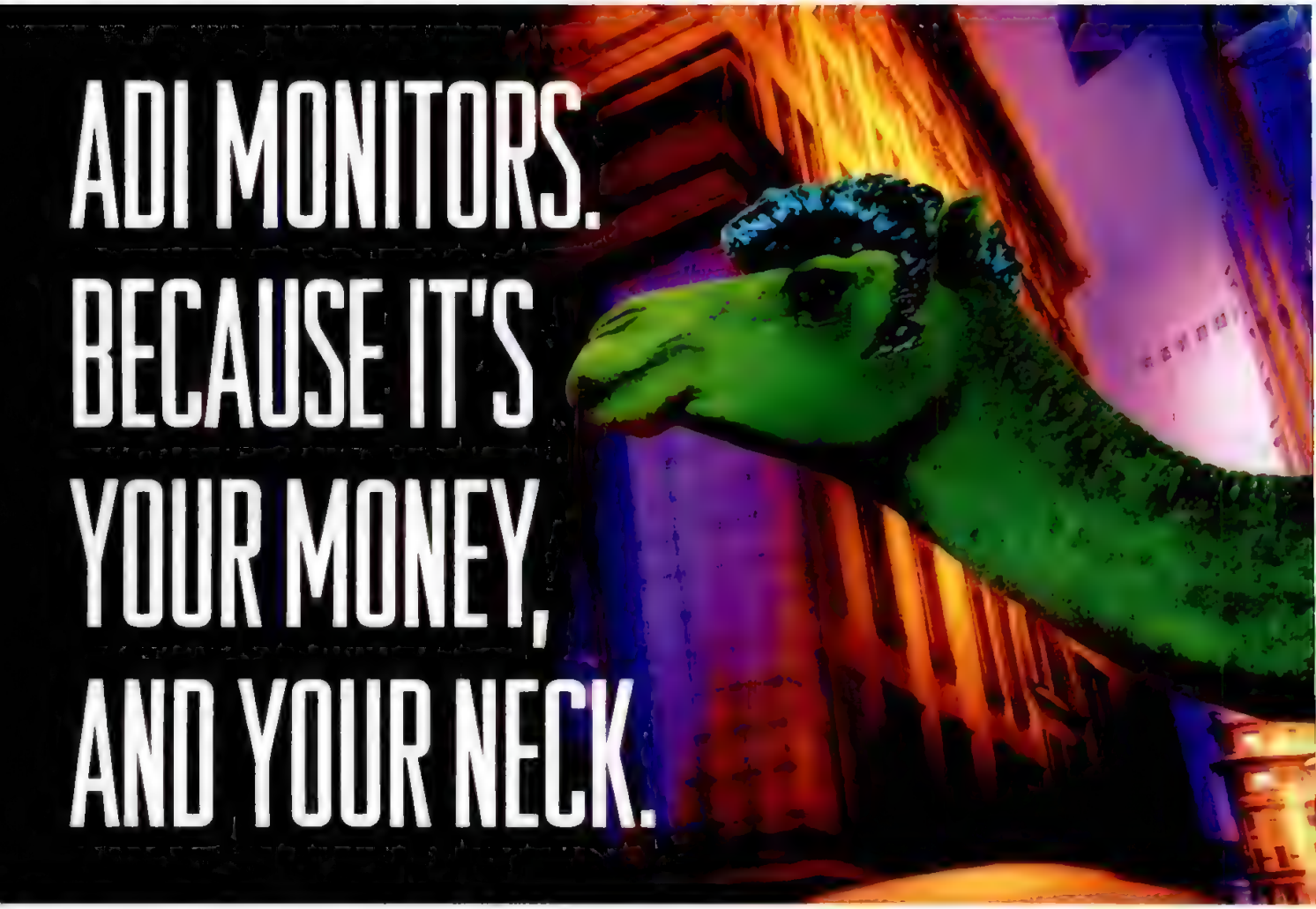

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You want a high-performance monitor. But if you spend too much or buy too little, it's your neck. So buy our monitor. Say the ADI MicroScan 17" 5EP or 15" 4GP. Who is ADI, anyway? We started by making performance monitors for other monitor companies. The quality we built into those monitors helped many of our customers become the best in the world. That helps explain why our MicroScan monitors match up so well with the NECs and the Sonys. That, and dozens of features. Microprocessor intelligence. 18-mode memory. Front-panel digital controls. Up to 76 Hz noninterlaced scanning or stunning, flicker-free images. Razor sharp resolution of up to 1280 x 1024. Special anti-glare, dark glass CRT surfaces. And ADI meets or exceeds every standard for manufacturing, power conservation, ergonomics and safety.

PC MAGAZINE EDITORS' CHOICE
March 16, 1993
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New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

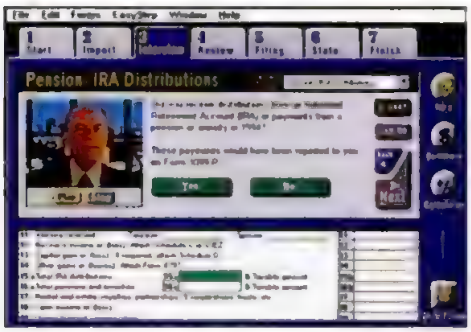
By Asa Somers

NEW

Multimedia Tax Package Offers Advice from the Professionals

Everyone seems to be buying CD-ROM drives these days, so it makes sense that software companies are repackaging their products and using multimedia to instruct and delight users. Along these lines, **Intuit** has released its new CD-ROM–based TurboTax Multimedia, a tax-preparation package that includes the 1994 version of TurboTax for Windows but goes that extra multimedia step.

TurboTax Multimedia includes full-motion video clips of tax experts offering you advice as you fill out your forms. The package also contains over 60 IRS publications and *The Money Income Tax Handbook* by Mary Sprouse. These documents are context-sensitive and are



***Fortune* magazine editor-at-large Marshall Loeb is one expert who advises you as you wrestle with your 1040.**

linked directly to TurboTax, so you can jump from the tax form right to relevant information in the reference material. The 1994 version of TurboTax now includes a newly designed interface that emulates Windows 95 and the TaxAdvisor, a feature that offers suggestions and points out overlooked deductions. The new SmartAudit feature is another welcome addition: It scans your entire completed return, flagging errors, omissions, and even possible audit triggers. It then takes you directly to each item needing correction.

▶ **TurboTax Multimedia.** Estimated street price: *$45; state forms package (28 states are available), $25 each.* Intuit, *San Diego, CA; 800-964-1040, 602-295-3000; fax, 800-756-1040.*

Circle 402 on reader service card

HOT PROSPECT

Canon's 12-ppm LBP-1260 Is Ethernet-Ready

The Canon LBP-1260 laser printer, the latest incarnation of the LBP-860, is **Canon Computer Systems'** newest entrant in the personal/workgroup printer market. The unit's features include 12-page-per-minute (ppm) printing and an optional Ethernet interface card, which should appeal to corporate as well as SOHO users

The LBP-1260 measures 12 by 17 by 16 inches (HWD) and contains an LBX-EX laser engine, which delivers 12 ppm at 600-dpi resolution. The printer comes standard with 35 Intellifont and 10 TrueType scalable internal fonts and 2MB of memory (expandable to 34MB)

Based on Peerless's Memory Reduction Technology, the LBP-1260 can print faster at low memory levels Canon includes a 250-sheet letter-size paper cassette and a 100-sheet multipurpose cassette with each LBP-1260 it sells Canon rates the life of its $155 EP-E toner cartridge at about 6,000 pages, which works out to a per-page operating cost of 2.5 cents

The unit comes standard with a parallel port and a serial port, while a new optional Ethernet adapter ($399) plugs into the printer's I/O slot, giving you network printing capabilities. Adobe PostScript and AppleTalk expansion options are also available for $499 and $699, respectively

▶ **Canon LBP-1260.** List price *$1,699.* Canon Computer Systems, *Costa Mesa, CA, 800-848-4123, 714-438-3000, fax, 714-438-3099*

Circle 401 on reader service card

NEW

VoiceType Dictation Now on the Windows Platform

The new VoiceType Dictation from **IBM**—which was formerly called the IBM Personal Dictation System and was available only for OS/2—now comes in a Windows version as well. According to IBM, it is the sophisticated statistical language model designed by IBM that gives this speech-recognition package the ability to convert voice into type at a rate of 70 to 100 words per minute with a claimed accuracy of 97 percent. VoiceType Dictation has a 32,000-word vocabulary.

The OS/2-based package is available in several non-U.S. English versions; the Windows-based package will be available in non-English versions later this year. IBM offers specialized language models for radiology, emergency medicine, and journalism that help your PC recognize technical vocabulary.

The package allows you to edit on-the-fly or after you have finished your train of thought, and VoiceType will even replay what you have said previously to remind you what needs to be changed. A voice-to-type hardware adapter and a compatible microphone are included with the software.

▶ **VoiceType Dictation.** List price: *$999.* IBM Corp., *Somers, NY; 800-825-5263.*

Circle 403 on reader service card

NEW

Multifunction PCMCIA Card Does Sound and Ethernet

Ositech Communications recently released the second installation of its Trumpcard series of PCMCIA devices. Called the King of Diamonds Type II multifunction card, the device combines an Ethernet network adapter and a sound card. It allows simultaneous access to an Ethernet network and 16-bit audio, so you can share your sound-annotated documents over the network without time delays or having to switch cards. The King of

Diamonds comes in either a business audio version, which offers 16-bit stereo playback and recording, or a higher-end version, which adds a 20-voice FM synthesizer, MIDI playback, and CD-quality playback and recording. Both versions support 10BaseT or 10BaseT/10Base2 wired networks, and each comes with headphones, a hands-free microphone, and Windows Sound System software. The King of Diamonds also features built-in power-management capabilities that will cut off power to the network portion of the card when it is not in use.

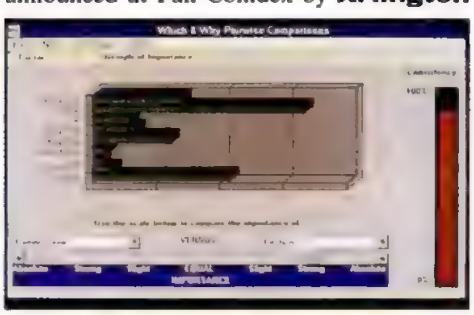
▶ **King of Diamonds.** List price: *Business audio version, $399; audiophile version, $499.* Ositech Communications, *Guelph, Ontario, Canada; 800-563-2386; 519-836-8063; fax, 519-836-6156.*

Circle 404 on reader service card

NEW

Which & Why Asks All the Right Questions

Which & Why for Windows, which was announced at Fall Comdex by **Arlington Software Corp.**, is a decision-support package that helps you compare alternatives, quantify decisions, and back up conclusions. The software analyzes both hard and soft data, which you input and organize into groups containing similar factors. Which & Why evaluates the decision model you have constructed and recommends the alternative that addresses your specific needs most closely. If cost is at stake, for example, Which & Why determines the price discount that must be applied to make all options equally attractive. The product contains over 100 decision models, including car selection and personnel hiring.



"Now, where to put that new microwave...?" Which & Why answers life's difficult questions.

▶ **Which & Why for Windows.** List price: *$349.* Arlington Software Corp., *Baie D'Urfé, Quebec, Canada; 613-746-1140; fax, 613-746-1140.*

Circle 405 on reader service card

BRIEFS

Software

GlobaLink has announced a new $595 version of Power Translator Professional for Windows, designed to translate business and technical documents. New features include the ability to import and export directly from major word processing programs, centralized dictionary databases for network use, point-and-click dictionary updating, and an on-line Grammar Module that also provides voice output in English, Spanish, French, or German. Users can upgrade from previous versions for $149 800-255-5660

Fixed Asset Pro, from **MoneySoft,** is a new fixed-asset and depreciation software package designed for small to mid-size businesses. The $195 product automatically calculates depreciation for determining book values, applies tax limits, and helps you forecast future depreciation. You can enter an unlimited number of asset records and Fixed Asset Pro will automatically transfer them to separate databases, allowing you to maintain many sets of books. Until March 31, you can receive Fixed Asset Pro for the introductory price of $149 800-966-7797

Portable Software Corp. has introduced QuickXpense for Windows to help business travelers deal with the hassle of filing an expense report. You enter your receipts electronically, and the $99.95 product will organize them by date and category into one of the 15 industry- and occupation-specific expense report forms that are included with the package. Portable Software will create an electronic version of your company's form for $49.95. QuickXpense features include mileage calculation, foreign currency conversion, and client tracking, and the package can even separate lodging, food, and telephone charges from a single hotel bill. 800-626-8620; 206-637-8808

Version 2.0 of ABC SnapGraphics ($99) is the latest release of **Micrografx**'s low-end business diagramming package. New SnapSteps give step-by-step instructions and shortcuts for creating and editing diagrams, while the Template Gallery suggests the diagram

NEW

ALR Announces 75-MHz Pentium Desktop PC

Advanced Logic Research has begun shipping its ALR Evolution X/75 desktop series of personal computers, powered by the new 3.3-volt Intel 75-MHz Pentium processors. These value-line PCs start at $2,400 and include PCI local-bus technology, Plug-and-Play compatibility, and Enhanced IDE (Mode 3) support. Eight megabytes of on-board RAM is standard, and the Evolution workstations can support a maximum of 264MB. Hard disks range from 210MB up to 1GB, and the units provide a total of seven expansion slots. You can have your PC shipped with either a 15- or a 17-inch MAG monitor. All Evolution units carry a 5 year, 15 month parts-and-labor warranty.

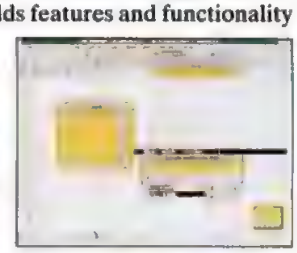
▶ **ALR Evolution X/75.** Estimated street price: *With 8MB RAM, 420MB hard disk, 64-bit graphics card, mouse, DOS, and Microsoft Windows, $2,400.* Advanced Logic Research Inc., *Irvine, CA; 800-444-4257, 714-581-6770; fax, 714-581-9240.*

Circle 406 on reader service card

IMPROVED

This Is a Good Place for a Stick Up: E•Glue Annotates Anything

Introduced at Fall Comdex, **Evergreen International Technology**'s Evergreen E•Glue adds features and functionality to the company's annotation product, Evergreen Notes 1.0a. E•Glue lets you attach electronic sticky notes (which can now contain sound, graphics, and animation) to documents and then send them to other users via a network. E•Glue also features a new graphical user interface and built-in templates such as to-do lists and phone messaging slips.



With E•Glue, you can post notes anywhere and even send them across the network.

▶ **Evergreen E•Glue.** List price: *$69.95; discounts for multiple orders are available.* Evergreen International Technology, *North Vancouver, British Columbia, Canada; 800-667-4340, 604-986-6121; fax, 604-980-7121.*

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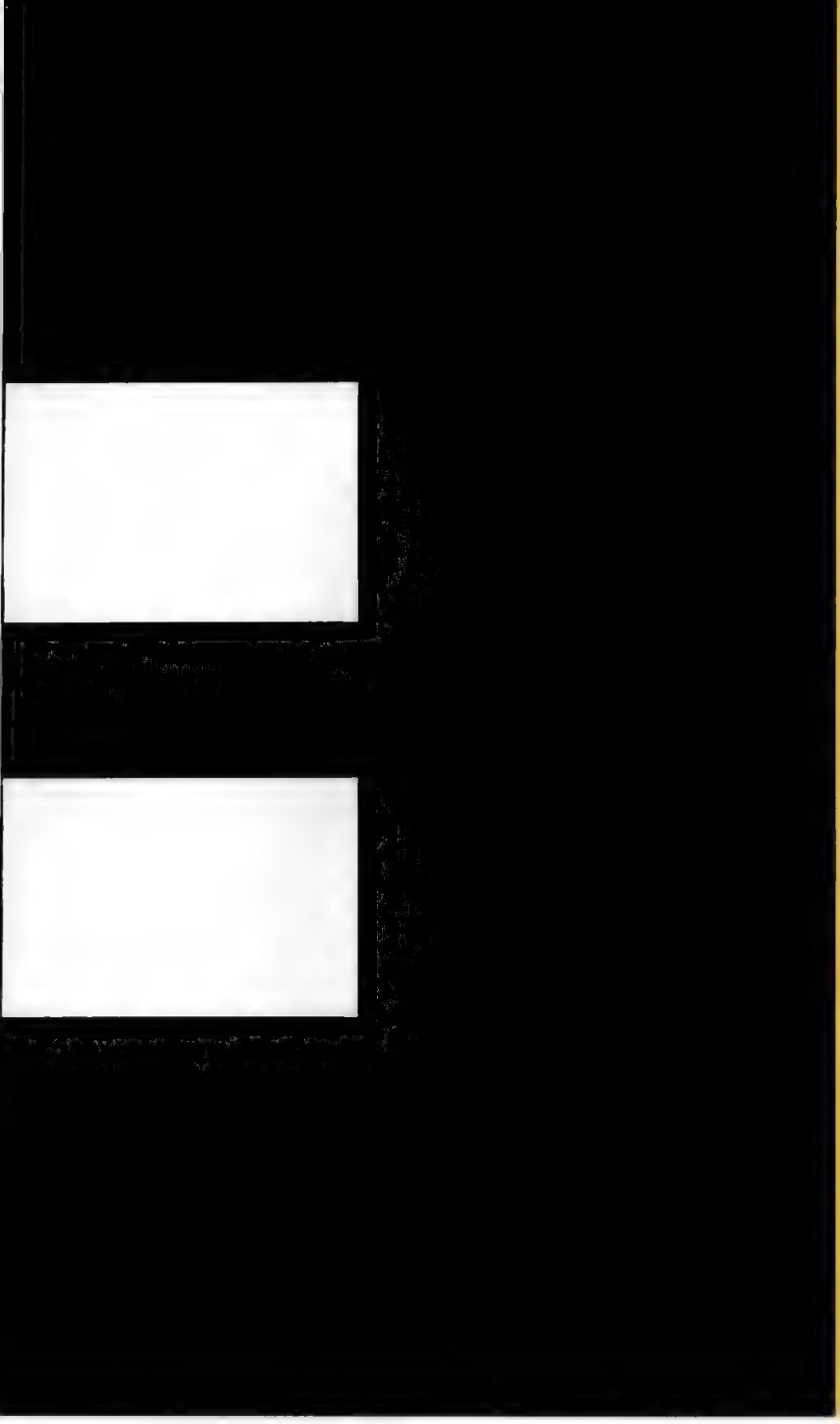

Plus there's brilliant color. The math couldn't be simpler.

Canon

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NEW

A Pen-Based Device That Takes a Licking and Keeps on Ticking

Kalidor has announced two new pen-based portable computers that are designed with ruggedness in mind. The K2100 and K2000F—each weighing 3.5 pounds—feature sealed cases engineered to withstand dust and moisture, and they have been drop-tested from up to 3 feet, according to the company. The K2100 is a 486-based PC, while the K2000F comes in both 386- and 486-based models and contains a flash disk in 10MB, 20MB, 40MB, or 80MB configurations. The K2000F has virtually no moving parts. Both units use nickel hydride battery technology and include 6- by 4.5-inch VGA touch-sensitive screens, local-bus video, and a tetherless pen. Each can contain up to 16MB of RAM, and Kalidor offers two PCMCIA Type II slots or one Type III slot as options.

Kalidor's new pen-based units are made to take the heat.

▶ **K2100** and **K2000F.** List price: *Prices start at $3,145 and depend on configuration.* Kalidor Inc., *Upland, CA; 800-252-54367, 909-931-3888; fax, 909-931-3885.*

Circle 412 on reader service card

NEW

Your PC Can Help Market Your Product

Business Resource Software has announced Plan Write for Marketing, a new product that includes all the tools necessary to generate a comprehensive marketing plan. The program presents you with a step-by-step outline that leads you through the planning process, taking into consideration such issues as market segmentation, evaluation of the competition, sales and distribution plans, and financial projections. Plan Write includes a glossary of marketing terms, its own word processor and integrated spreadsheet, and a chart generator that uses supplied data to create any of 14 different chart types.

▶ **Plan Write for Marketing.** List price: *$129.95.* Business Resource Software Inc., *Austin, TX; 800-423-1228, 512-251-7541; fax, 512-251-4401.*

Circle 413 on reader service card

BRIEFS

Software

type that will best suit your specific needs. The new version features improved time line automation and automatic flowchart shape numbering, and will automatically fit shapes to text. The package is Microsoft Office–compatible and supports OLE 2.0. Until March 31, SnapGraphics costs only $49.99. 800-676-3110.

VisualTools has begun shipping Release 2.0 of its Formula One spreadsheet tool. Developers can create Windows-based applications in Visual Basic, C, Visual C++, and Borland C++. Formula One is compatible with Excel and features enhanced calculation speed and new functions to reduce programming time. The $249 product also includes a link to VisualTools' new First Impression charting software. Registered users can upgrade to Release 2.0 for $69. 800-884-8665, 913-599-6500

GroupQuest Software has begun shipping Essential Tools, Version 2.0a, an OS/2-based administration utility for automating day-to-day Lotus Notes tasks. Administrators can add or remove multiple groups and individuals from the Notes address book in a single transaction, alter access control levels, and run administrative tasks during off hours. A new NetWare-based version should be shipping by the time you read this. The product lists for $1,995 for the first server and $995 for each additional server. 800-864-5061, 310-201-0747

Hardware

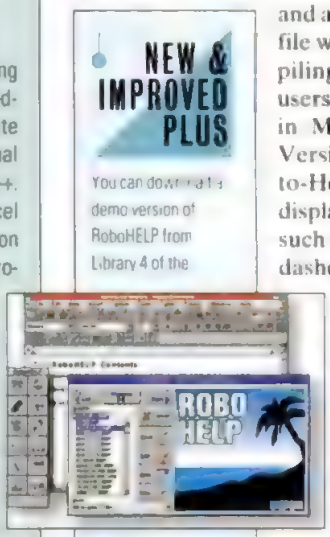
At Fall Comdex, **Samsung** introduced the new SyncMaster 15GLi ($560) and 17GLi ($849) color monitors, both of which feature 1,280-by-1,024 resolution at 60 Hz. Each of the two models has a 0.28-inch dot pitch, an Invar shadow mask, and a Dynamic Focus feature for image crispness. Both come with push-button controls and power-management capabilities that comply with both Energy Star and MPR II guidelines. 800-933-4110, 201-229-4067

Alaris has begun shipping the new Stinger 64-bit PCI graphics card, which is based on the S3 Vision864 processor.

IMPROVED

RoboHELP Lends a Hand with Creating Help Files

Blue Sky Software Corp. has begun shipping the latest release of its RoboHELP authoring software, now in Version 3.0. Windows help-file authors will definitely appreciate the package's new HelpCheck Tools features, which search for syntax errors and allow you to test your file without actually compiling it. RoboHELP users can create help files in Microsoft Word 6.0; Version 3.0's new Word-to-Help technology will display special features—such as smart quotes, en dashes, and bulleted lists—just as they appear in Word 6.0. New document templates, a new macro editor, and an enhanced visual interface increase RoboHELP's efficiency and power. For a limited time, Blue Sky is including the $199 Multimedia WinHelp product (which lets you incorporate multimedia elements into your Windows Help files) at no extra cost. This can extend the help section of a program with audio explanations, video clips, or screen demonstration software.



▶ **RoboHELP, Version 3.0.** List price: *$499; upgrade from earlier version, $149.* Blue Sky Software Corp., *La Jolla, CA; 800-677-4946; 619-459-6365; fax, 619-459-6366.*

Circle 408 on reader service card

NEW

Conner's RAID Solution: Lots of Space, Fault Tolerance

RAID (Redundant Array of Inexpensive Disks) is a storage option for networks that uses multiple disk drives spinning simultaneously to achieve faster performance and increased data security. **Conner Peripherals** has begun shipping its 12-disk CR12-RAID system, which provides up to 25 gigabytes of storage capacity. The system supports RAID levels 0, 1, and 5, and is compatible with NetWare 3.*x* and 4.*x* and

Avoid The Mistakes That Trigger An IRS Audit With New TurboTax For Business™

The #1 way to avoid an IRS audit is to *"Prepare your tax return with tax software. The IRS feels computer-generated returns are less likely to contain computational errors."* says Fred Daily, tax attorney and author of *Tax Savvy for Small Business.*

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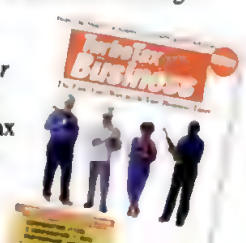

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Windows NT Advanced Server environments. The CR12-RAID is available in either a tower or rack-mount model, and you can configure it with up to 12 hot-swappable Conner FilePro Performance hard disks—each with a 1 or 2GB capacity. To maximize fault-tolerance, the CR12-RAID comes with a configurable, on-line hot spare drive and up to three hot-swappable power supplies and two cooling fans. You can manage the unit remotely from any PC on the network using Conner's StorView software, and an alarm sounds if power to any component of the system fails.

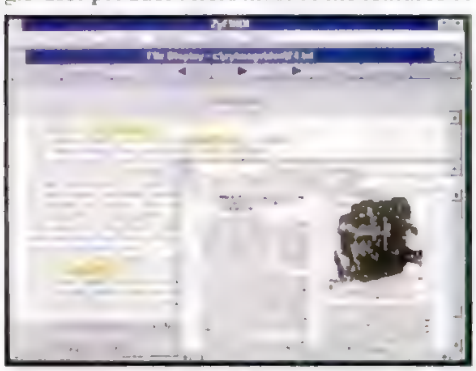
▶ **CR12-RAID.** List price: *Prices start at $14,995 and depend on configuration.* Conner Peripherals, *Lake Mary, FL; 407-263-3500; fax, 407-263-3555.*

Circle 407 on reader service card

NEW

Personal Text-Retrieval Software Works with Calera's WordScan

ZyLAB has introduced ZyImage Personal Edition, an entry-level, single-user document-filing solution based on the company's networkable ZyImage 3.0 for Windows. The single-user product offers most of the features of



ZyImage PE's fuzzy search technology finds words even if they are misspelled.

the full version, lacking only network capabilities and the automated CD-ROM publishing technology. ZyLAB is marketing ZyImage PE with Calera Recognition Systems, maker of the OCR package WordScan. The icons in ZyImage PE's interface are integrated into the WordScan toolbar, allowing you to scan, index, and file documents without having to load an additional application. After you input a document, ZyImage PE indexes every word for later retrieval.

▶ **ZyImage Personal Edition.** List price: *$495.* ZyLAB Inc., *Gaithersburg, MD; 800-544-6339; fax, 301-590-0903.*

Circle 415 on reader service card

BRIEFS

Hardware

The Stinger supports 24-bit color at up to 800-by-600 resolution and comes standard with 1MB of high-speed DRAM, allowing for resolutions of up to 1,280-by-1,024. Memory is upgradable to 2MB, which will provide up to 1,600-by-1,200 resolution. The $249 Stinger is Energy Star–compliant and offers flicker-free refresh rates using a 135-MHz RAMDAC. 800-317-2348

Diamond Multimedia Systems has created the $499 Diamond Multimedia Kit 4000, which bundles a quad-speed CD-ROM drive, a 16-bit Sound Blaster–compatible sound card, speakers, and 11 CD-ROM titles. The CD-ROM drive has an access time of around 200 ms and a maximum transfer rate of 600 KBps. The sound card can be upgraded to wavetable synthesis, and the CD-ROMs include Compton's Interactive Encyclopedia 1995 Edition and Interplay's 10-Year Anthology, which features entertainment and games programs. 408-736-2000

Altec Lansing Computer Products has announced two new communications products: the $600 AVC1000 real-time video conferencing system and the $100 AT100 multimedia telephony device. The AVC1000 delivers digital full-motion and still-video imaging, high-res annotations, high-quality sound, and a host of telephony features. The AT100 is an I/O product that controls all the multimedia and telephony devices of your PC. It features infrared transceiver technology for wireless operation and comes with drivers and application software. 800-648-6663

And Finally. . .

Dell is bundling Reality Online's Reuters Money Network investment program with its Latitude line of notebooks. . . **Xircom** will begin bundling Traveling Software's LapLink for Windows with its new CreditCard Ethernet+Modem II. . . **IBM** is now offering the ThinkPad Traveling Executive Solutions, two preloaded software bundles for business customers. The packages can be bundled with either a ThinkPad 360CSE or 755C.

NEW

SciFinder Puts Chemical Information Within Reach

Doing scientific research without having to go to the library is now possible with **Chemical Abstracts Service**'s SciFinder client/server application. The CAS Registry is an on-line database of 13 million chemical substances and more than 11 million articles and patents. SciFinder allows you to search the database with three research functions: Explore, Browse, and Keep Me Posted, the last of which monitors new literature on selected subjects and alerts you to recent arrivals. A document analyzer feature automatically evaluates a file for certain information specified by the user. Pricing is set up on a case-by-case basis in both subscription and per-use scenarios.

▶ **SciFinder.** List price: *$20 to $40 per task (subscription rates and per-hour pricing negotiated on individual basis).* Chemical Abstracts Service, *Columbus, OH; 800-848-6538, 614-447-3600; fax, 614-447-3713.*

Circle 414 on reader service card

IMPROVED

Hayes Gets on the V.34 Bandwagon

With the ratification of the V.34 transmission protocol, the proliferation of compliant modems has been swift. **Hayes Microcomputer Products** has begun including 28.8-Kbps transmission capabilities with two of its products: the small-office/home-office Accura 2880 V.34/V/FC + Fax modem and the upper-echelon Optima 28800 V.34/V.FC + Fax modem. The Accura supports up to 4-to-1 data compression and a maximum data-transmission rate of 115,200 bps. The Optima supports 8-to-1 data compression and a maximum speed of 230,400 bps, ideal for the transfer of large files and for connecting to a LAN. Both models support a number of other protocols, and Hayes bundles the ESP Communications Accelerator, a 16-bit serial card that enhances throughput and reduces data loss. The Accura includes Smartcom for Windows LE and Smartcom FAX for Windows LE.

▶ **Accura 28800 V.34/V.FC + Fax.** List price: *$299; upgrade from earlier version, $49 (until March 1).* **Optima 28800 V.34/V.FC + Fax.** List price: *$579.* Hayes Microcomputer Products Inc., *Norcross, GA; 404-840-9200; fax, 404-441-1213.*

Circle 409 on reader service card

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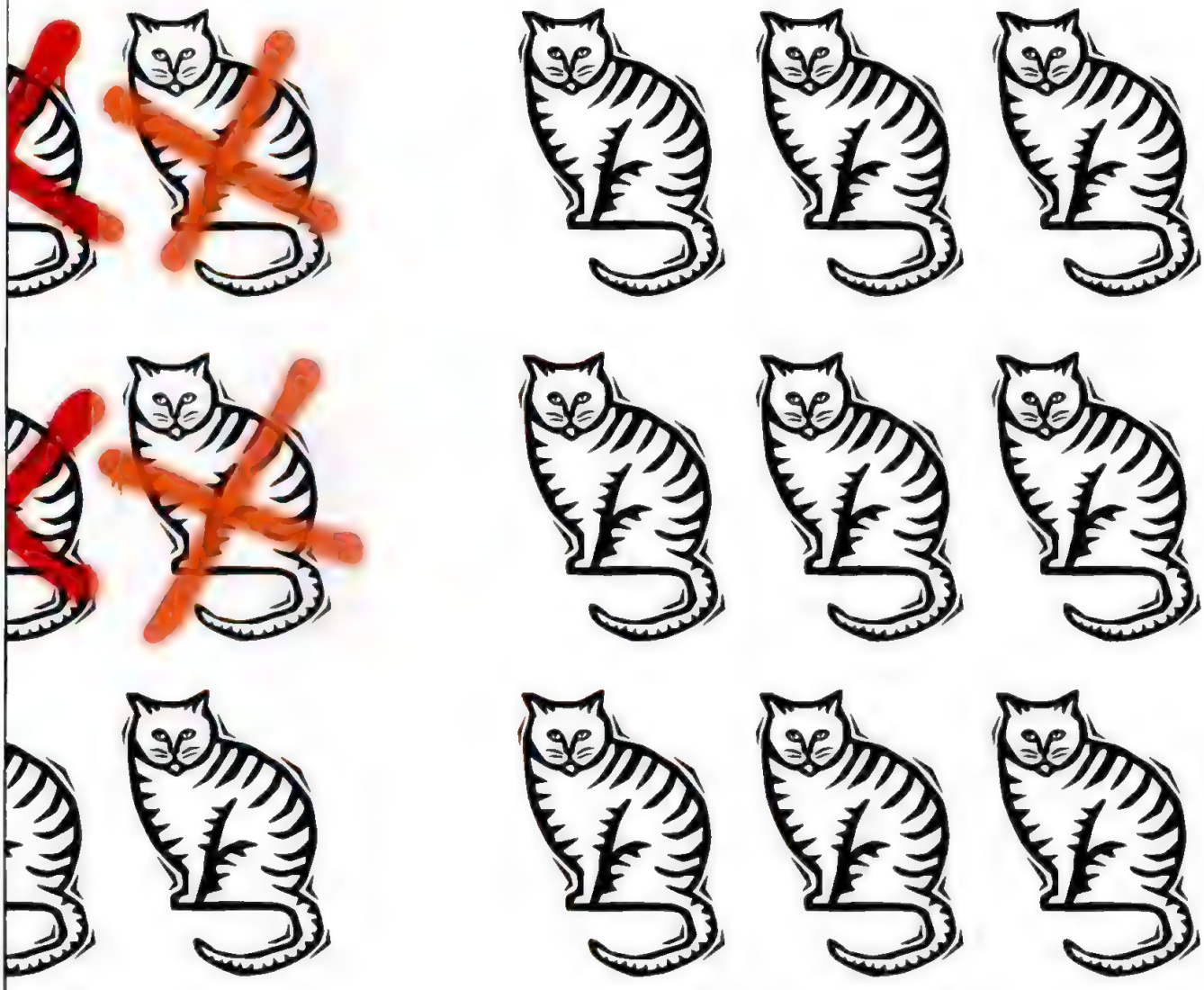

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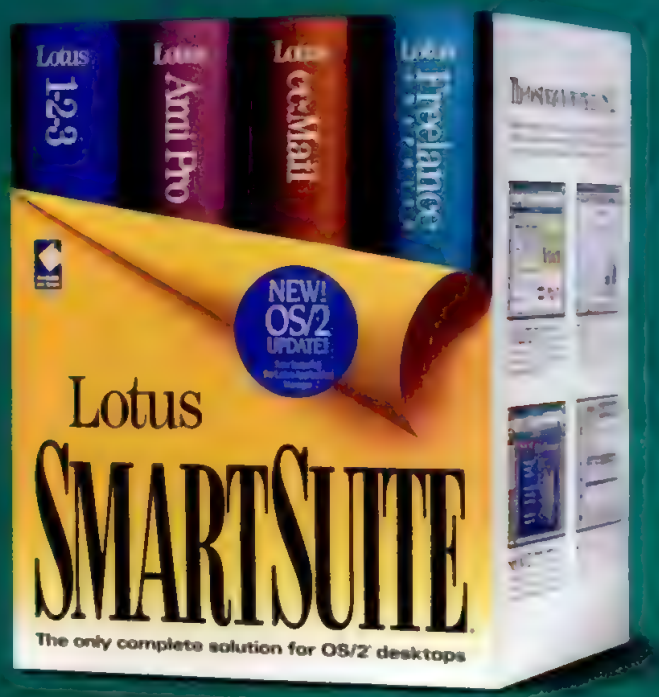

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Read Only

REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Tin Albano

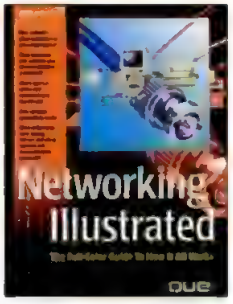
Nice Nodes and Pretty Pictures

BY SUSAN GREGORY THOMAS

Nobody, save a bona fide net-nerd, would call a network "pretty." But *pretty*—sometimes downright *gorgeous*—definitely describes the LANs, WANs, and MANs pictured in Eddie Kee's *Networking Illustrated*.

A coffee table book geared to aspiring LAN administrators (or anyone interested in how networks operate), this introductory text guides readers through basic as well as fairly complex networking issues with the soothing authority of an Acousta-Guide tape recorder at a museum; indeed, *Networking Illustrated* could pass for an art book. Its large, heavy-bond pages—which balance vast white spaces and crisp, colorful graphics—are so handsomely designed that one almost forgets that it's a book on networking. But this raises a central question: Is it a coffee table book or a serious technical manual? In short, how is this book meant to be used?

It's hard to tell in some cases. *Networking Illustrated* is certainly not a how-to book, nor is it an encyclopedia, though it does cover a lot of ground. Divided into ten chapters—beginning with an overview of networks and ending with backup systems—*Networking Illustrated* tours network topologies, the OSI model, operating systems, protocols, and more. Each chapter has, on average, about ten sections that cover appropriate concepts or technologies; evidently in the interest of staying novice-friendly, these sections are pared down to about a paragraph or two of text, supplemented by little "Facts" boxes, which focus on pertinent points. While this minimalist approach keeps the book looking attractive, readers who are unfamiliar with the technical terms presented will often have to consult the glossary to weed their way through often complex information. For example, chapter 4 is devoted to "Network Topologies," but nowhere in that chapter is "topology" defined. Luckily, this term—like many important terms used throughout the book—is highlighted, which signals readers that they should turn to the back of the book for a definition.



Kee is really at his best explaining concepts rather than nuts-and-bolts tech-talk. He does a nice job, for example, of explaining read/write access on networks, document sharing, and Token-Ring–based networks; the accompanying graphics work well as visual metaphors. But the book in general wrestles with the age-old battle between brains and beauty. In the case of networking books, anyway, one may have to conclude that you just can't have both.

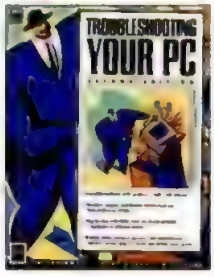
▶ **Networking Illustrated,** *by Eddie Kee, $24.99.* Que Corp., *800-428-5331. ISBN: 1-56529-893-4.*

Circle 501 on reader service card

Shoot Your PC Troubles Away

BY NATE ZELNICK

Troubleshooting Your PC, a hefty guide to solving basic problems from Jim Aspinwell, Rory Burke, and Mike Todd, is a good bookshelf addition for the user who knows a little about what happens when he flicks on the switch, but lacks an electrical engineering degree.



Troubleshooting starts with the basics. Early chapters attempt to remove the mystery of a PC's innards by giving an overview of the subsystems and a few basic tips on how to identify where a problem might lie. Reading the first three chapters should provide enough basic information to identify a problem.

Because the last thing you want to do when you have a problem is read a 700-page book, each chapter ends with a set of symptoms, a list of "suspects," and possible solutions. Chapter summaries provide an explanation for why the problem may have occurred in the first place. The symptom list is duplicated at the beginning of the book for easier access.

Many of the offered solutions are probably too technical for a casual reader, however. For a user faced with a PC that refuses to turn on, for instance, *Troubleshooting* advises you to first reduce the clock speed, then to check CMOS setup parameters, lower ambient temperature, and finally, replace the CPU. This would be cold comfort for a novice weekend worker skimming to solve this problem.

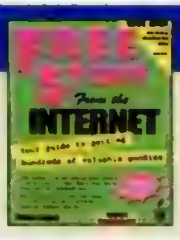
The book does offer a reasonably logical map to where problems may arise, starting with configuration errors. It walks you through the arcana of CONFIG.SYS and AUTOEXEC.BAT files, hardware and operating system problems, and diagnostic software packages that can aid in detective work. Included with the book is DiagSoft Inc.'s QAPlus, a list of vendor BBS services, and a shareware communications program called COM-AND (so you can dial up for help).

While *Troubleshooting Your PC* won't get you to the point where you'll be commanding legions of tech-support workers, it's a good introduction to the basics for users irked at mysterious IRQ problems or confounded by COM port conflicts.

▶ **Troubleshooting Your PC,** *by Jim Aspinwell, Rory Burke, and Mike Todd, $32.95.* MIS Press, *800-628-9658. ISBN: 1-55828-378-1.*

Circle 502 on reader service card

Read Only Recommends



What does everybody want? Free stuff. So if you're a superhighway aficionado, take a look at Patrick Vincent's *Free Stuff From the Internet.* $19.99, Coriolis Group Books, 602-483-0192; ISBN: 1-883577-11-X.

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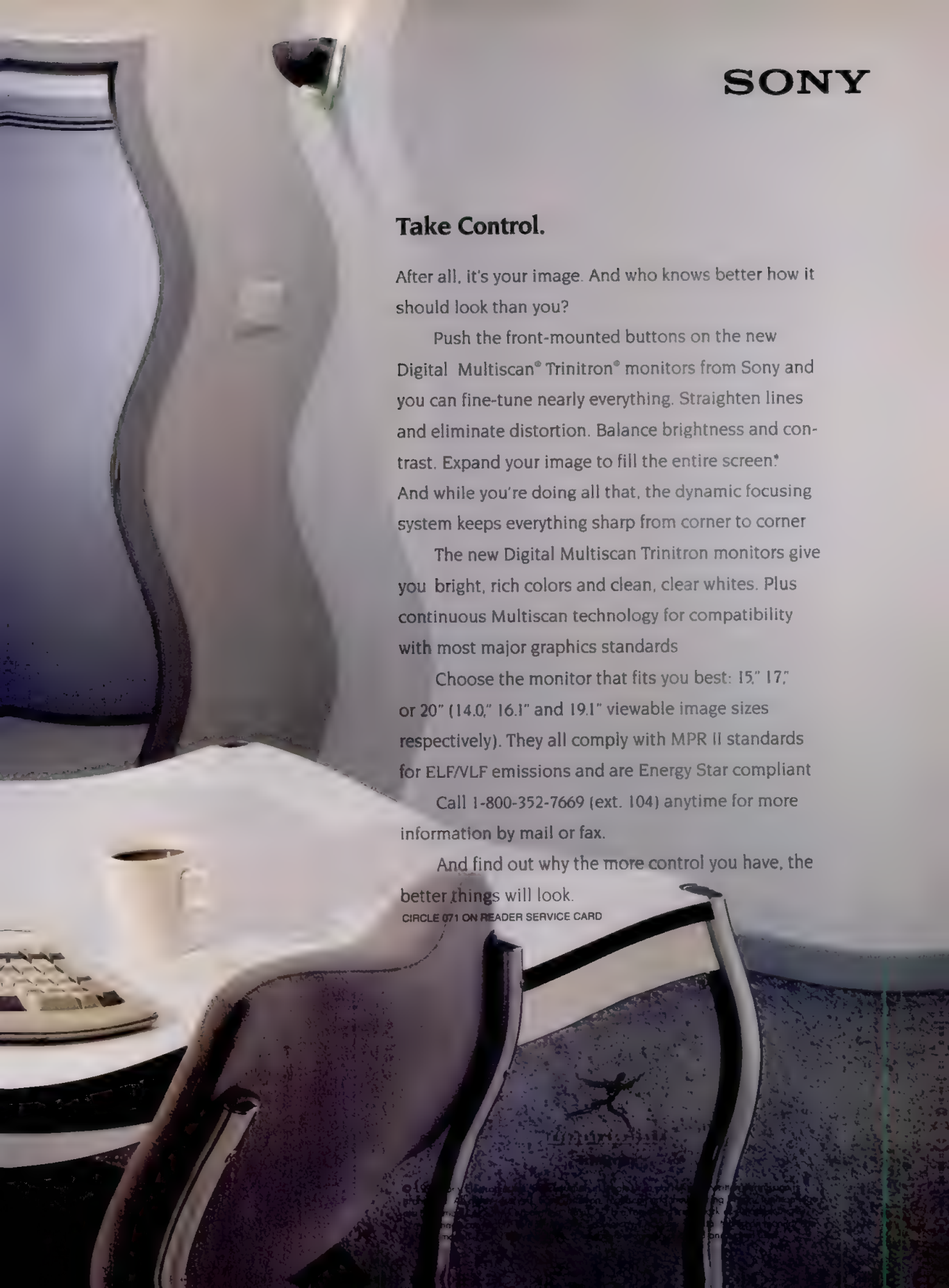
CIRCLE 137 ON READER SERVICE CARD

SONY



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CIRCLE 001 ON READER SERVICE CARD

Michael J. Miller

The World According to Microsoft

If you think Microsoft is too dominant in today's computer industry, a quick look at where the Bill Gates juggernaut is headed may prove disheartening. Already the leading provider of operating systems and office productivity applications, Microsoft wants to carry its success over to other areas, ranging from interactive television to financial services. With its recent announcements, acquisitions, and introductions, Microsoft is making its goal clear: It aims to become a ubiquitous part of tomorrow's information infrastructure.

THE RIGHT TOOLS

While Intel seems to face more competition than ever, Microsoft's position in the operating-system market has gotten stronger. The reason for this continued success is twofold. Confusion and a lack of focus from OS competitors—such as IBM and Apple—certainly helped, but Microsoft also gave itself quite a boost by developing tools like Visual Basic and Visual C++.

Not too long ago, Borland surpassed Microsoft in the quality of its tools. But more and more, the big firms I talk to are moving to Microsoft tools. This kind of support gives Microsoft the ability to decide which technologies to push and which platforms to support, as well as which technologies to license and which to keep for itself. For instance, Microsoft was first on the market with products that really supported OLE 2.0. Now that it wants OLE 2.0 to be widely supported, it has done a very nice job of making OLE support easier by providing Wizards in its Visual C++ package.

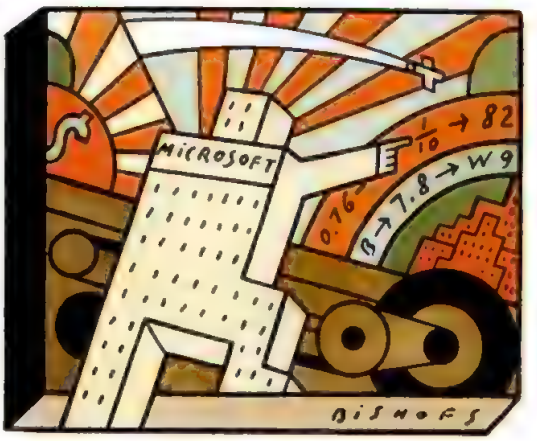
Microsoft wants OLE to be the object standard, and wants to establish it before OpenDoc or Taligent gets off the ground. Microsoft even wants to control object standards on other platforms, hence its introduction of tools that make it easier for developers to take Windows applications and move them to other platforms, such as Macintosh, with built-in support for OLE. Not only does this kind of accommodation push Microsoft's APIs, it also makes it easy for vendors to use Windows as their primary development platform, regardless of what their target system might be. This will, of course, lead to code that is optimized for Windows. (Okay, Microsoft is a bit confused here. This is because part of the company wants to protect the rights of its Word and Excel teams by insisting on special terms for using the cross-platform code for people who write word processors or spreadsheets.)

THE RIGHT NETWORK

The dominance in tools, applications, and operating systems may be just the beginning. Consider Microsoft's recent announcements, such as Microsoft Network, a new on-line service that will be bundled with Windows 95.

Microsoft Network, once code-named Marvel, may well be the first thing users see when they start the new operating system and it may be the best way to get Microsoft support. If users choose to subscribe to Microsoft Network, the company could wind up getting a steady stream of $4 to $5 a month from everyone on its operating system, and that could mean several hundred million dollars a year.

Microsoft isn't the only one with this idea. IBM is doing the same thing with OS/2 Warp by bundling in Internet access through its Advantis service, which then sets up a continuing monthly fee. In fact, you can almost view these two operating systems as loss leaders for their suppliers' on-line services. Since Microsoft is in a position where its operating system is dominant, however, users will be more likely to try its network service first. In order to be successful, Microsoft Network doesn't even have to be the best on-line service; it just



Microsoft plans to be the backbone of tomorrow's information infrastructure.

Illustration by Mars Bishofs

Michael J. Miller

needs to be good enough and the most convenient. And including Microsoft Network with Windows 95 will certainly help.

Now take Microsoft's recent plans to acquire Intuit with its Quicken personal finance program (which links to a check-paying system), and add that to the likelihood of Microsoft Network's success. Because of its size, Microsoft is in a better position to work out relationships with large banks and other financial players. Imagine how Microsoft could extend electronic banking onto an online service such as Microsoft Network. Microsoft could require just a small service charge on each transaction. Or it could make money on the float—the interest in the few seconds it takes to move money from one place to another. Or both.

Microsoft's success in one area helps it extend its success in other areas. Because Windows is so successful, developers must develop for it. If Microsoft Network becomes successful, more developers and content publishers will support it. The same reasoning will apply to Microsoft's Tiger system for delivering video and other content to set-top boxes, or even to the far-off plan of developing wallet PCs with access to financial information.

UNCHARTED WATERS

All this may sound inevitable, but it isn't. First of all, no one—not even Bill Gates—is successful with every product he introduces. Just think about Microsoft Money. And does anyone out there remember the first Microsoft Access, the abortive Crosstalk competitor? Not too many folks, obviously, or Microsoft couldn't have recycled the name for use on its database.

Microsoft still has a lot of strong competitors who envision a different future. Novell, for instance, is still the clear leader in network operating systems and has recently announced plans with General Instruments, the leader in cable set-top boxes.

To date, Microsoft's track record in communications products is less than stellar. Lotus's cc:Mail and Notes have a larger market share than Microsoft Mail. Notes practically defines groupware and Lotus's plans to make Notes a wide-area product through its relationship with AT&T makes it a strong competitor in the world to come. Microsoft is getting into areas where it will face new competition, in addition to its traditional software competitors, from banks to television and cable companies. In many cases, these firms have unique relationships with customers or content that Microsoft can't easily duplicate.

The more Microsoft focuses on pushing its existing platforms and operating systems, the more likely it is that there will be some outside force, some new technology, that Microsoft either won't see or won't commit to quickly enough. This would leave room for new competitors. Remember, it wasn't too long ago that IBM, Digital Equipment Corp., and Wang were the dominant information companies, and look what happened when the technology changed.

Still, if you're worried about Microsoft's dominance today, you have good reason. It may foreshadow a future where Microsoft has a hand in every area of your life—from communications to entertainment to paying your bills. The road to this future won't be easy, but Microsoft is very determined and is certainly in a better position than almost anyone else to ride out the inevitable storms. □

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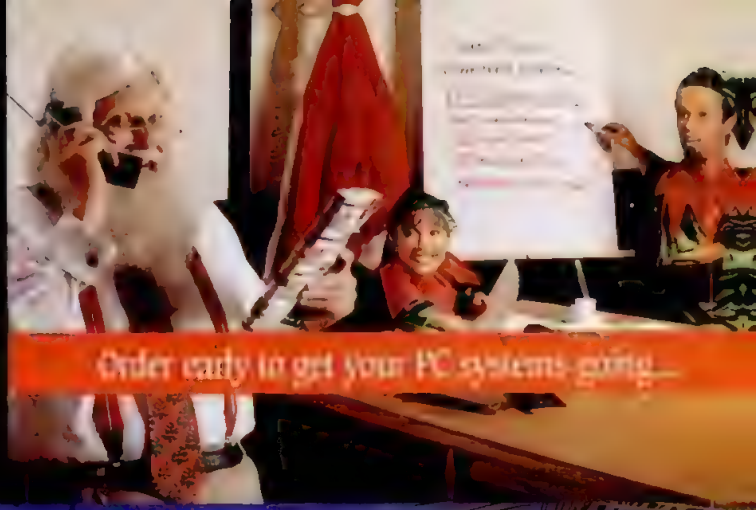

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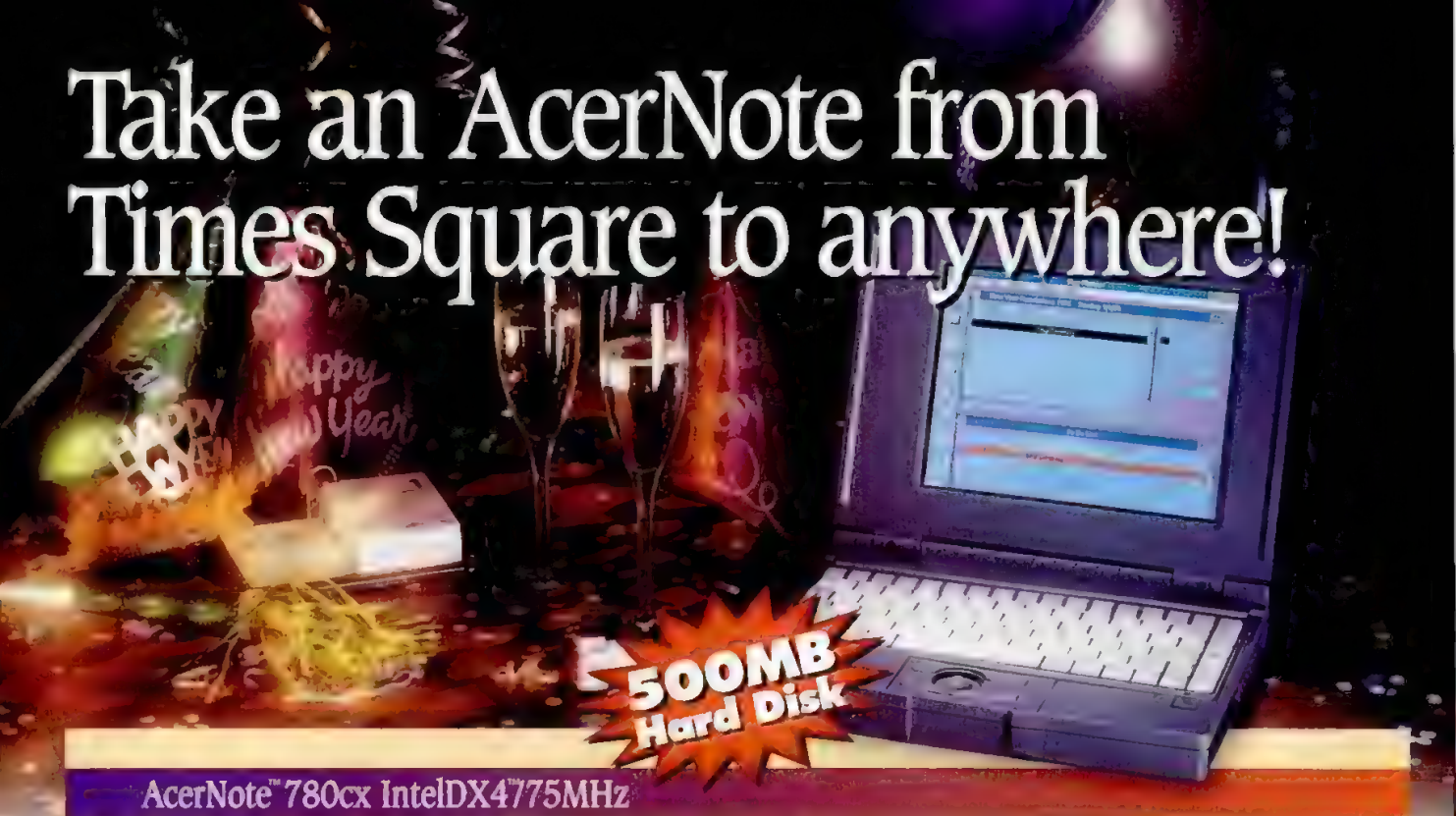

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Bill Machrone

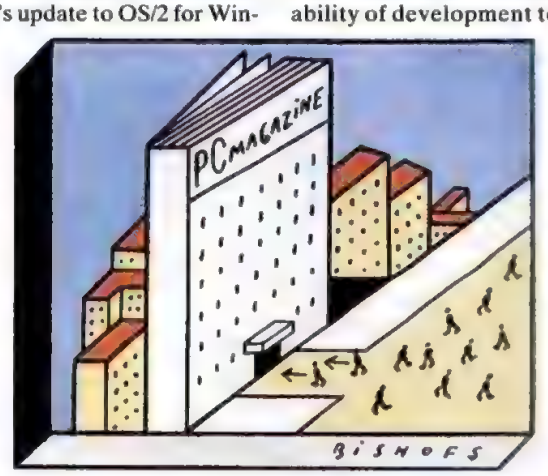
Do OS/2 Users Hate *PC Magazine?*

What we have here is a failure to communicate. Many dedicated OS/2 users think we're a bunch of Microsoft shills. For our part, we can't understand their ire, because Ziff-Davis publications overall, and *PC Magazine* in particular, publish more articles that cover OS/2 than any other non-OS/2-specific publication. Also, we got on the OS/2 bandwagon before anybody else. Back in the days of Version 1.0, when it looked as if OS/2 would be the successor to Windows, we had extensive, continual coverage of OS/2—including two fine programming columns written by Charles Petzold and Ray Duncan. Other star programmers contributed OS/2 utilities. We were gearing up for the future.

Then the IBM/Microsoft partnership fell in tatters. From the shattered remnants, NT emerged as "a technology, not a product." Then Windows NT began to take form as a product and seemed likely to inherit all the good stuff developed for OS/2. Since we were underwhelmed by DOS and thoroughly fed up with the bugs, limitations, and hassles of Windows, we turned our attention to Windows NT. You'll recall that IBM was all but silent, saying only that they had cross-licensed some unspecified technologies with Microsoft, and would continue to sell and support OS/2. In retrospect, it must have been a stunned silence.

Three things have caused us to take a fresh look at OS/2. The first is Warp, IBM's update to OS/2 for Windows. The second is the steadily receding ship date for Windows 95. The third is OS/2's user base, which has quietly grown to around 6 million. Compared with 60 million Windows users that may not seem like much, but compared with 600,000 Windows NT users, it's pretty significant. Also, if O/S 2 were anything but an operating system, it would be a runaway best-seller.

I decided that I no longer understood who was using OS/2 or why. So I went to the on-line community to get some current information. I posted a message in two places where OS/2 users hang out. My message was quickly copied to the Internet, and in no time I had many hundreds of responses. I corresponded with and spoke to as many people as I could over the next week or two, and came away with a new understanding of OS/2 users. Here's what I found.



Three recent developments have inspired us to take a fresh look at OS/2.

• **They're software-intensive.** In my judgment, OS/2 users wring out more performance from their machines by using more of the features in their software and by taking full advantage of OS/2's multitasking. They tend to be more oriented to software performance than hardware performance, and as a group are more intolerant of sluggish software. They run multiple applications simultaneously and are intolerant of slowdowns or pauses.

• **They're developers.** OS/2 is far more robust than Windows, because it uses different memory management techniques. It does a superior job of isolating applications from one another and gives DOS sessions a large virtual machine. When the application you're developing crashes, you reboot the virtual session, not the whole machine. Also, OS/2 users are delighted with the availability of development tools designed to port legacy mainframe applications to client-server environments. Many OS/2 users write vertical applications, and OS/2's tools let them deliver applications faster; the robustness of the environment also keeps users running better and holds down support costs. REXX, OS/2's native scripting language, lets users move far beyond the capability of macro recording to automate tasks and create meta-applications.

• **They're not iconoclasts and contrarians.** Yes, there are rugged individualists and platform bigots within the ranks of OS/2 users, just

Illustration by Maris Bishofs

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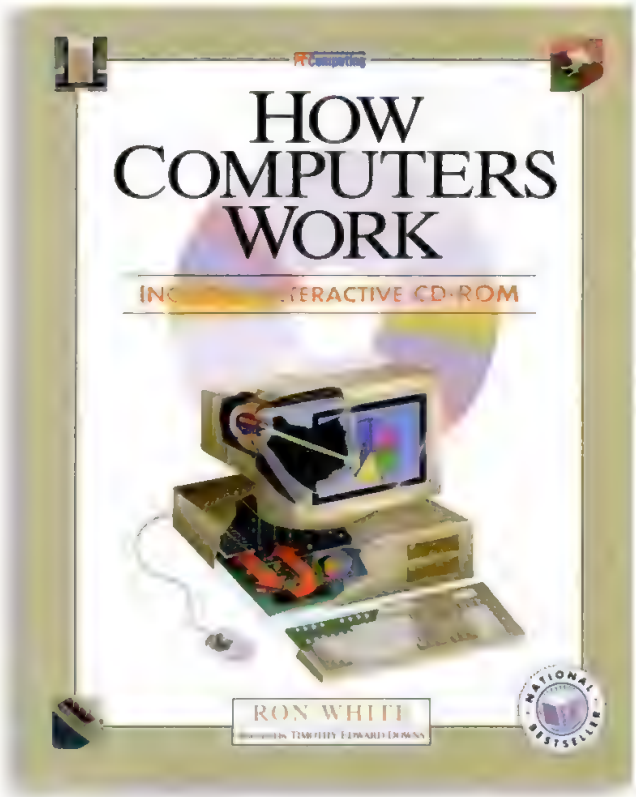

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Bill Machrone

as with Windows, DOS, Macintosh, and Unix. I got my share of "Why would a Ziff-Davis editor want to know about OS/2?" and "I'm not going to talk to you because you hate us anyway" messages. The worst was, "We don't read Ziff-Davis publications *because* we're OS/2 enthusiasts."

- **They're knowledgeable.** They bought OS/2 because they knew they had a choice. They have experience with other operating systems, including VMS, MVS, Unix, and, of course, DOS and Windows. They use and appreciate OS/2's extended user interface capabilities, such as drag-and-drop and control over properties. They're insulted by Microsoft's attempts to position these features as new in Windows 95.
- **They're realists.** They use market-leading Windows applications. They take the best that the industry has to offer and run it in an environment that they consider to be less fragile and more crash-resistant, as well as a better integrating platform. They see OS/2's flaws as well as its features. They've been waiting forever for IBM to fix the single asynchronous input queue, which can be a performance bottleneck and is a potential Achilles' heel, where one application can interfere with another. They find fault with IBM's technical support. They wish IBM would put more marketing muscle behind OS/2. They know that they can't use OS/2 and live at the bleeding edge of the hardware market. Heck, board manufacturers have a tough enough time making Windows drivers that work; OS/2 support is almost always an afterthought. Many users have been waiting impatiently for the just-shipped native version of LANtastic for OS/2. They're tired of having to go through DOS for their peer-to-peer networking applications.

IBM remains committed to OS/2, and Warp with the BonusPak is an incredibly good deal. Still, the future for OS/2 is problematic. Windows 95 will erase most of the advantages that OS/2 has enjoyed for the past several years and offers some additional capabilities, such as plug-and-play and full Win32 support. Meanwhile, major customer sites have settled on Warp as their 32-bit environment. They're anticipating the delivery of PowerPC machines and the portable, microkernel-based OS/2. One correspondent went so far as to say, "We are poised for the future, but Ziff-Davis is not." I'll take that as a warning, but it feels like we've already been there. □

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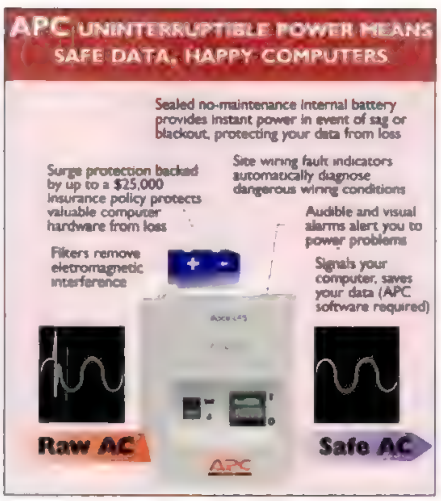

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CIRCLE 038 ON READER SERVICE CARD

John C. Dvorak

E-Mail Love and War Stories

This is the story of how one hapless e-mail user sent 100 copies of a love letter to 100 surprised recipients. What was intended to be a confidential e-mail sealed with a kiss for that special someone turned into a rather embarrassing situation. One simple mistake at the keyboard and the letter was sent via MCI Mail to an entire list of people at the company. Oooops!

After trying all sorts of ways to retrieve it, this person contacted MCI Mail to recall the love letter. No dice. It can't be done. Hitting the Send button is equivalent to dropping a letter in a mailbox. Nothing can stop its delivery, explained a spokesperson from MCI Mail; like regular mail delivered by the postal service, e-mail can't be unsent.

I take issue with this policy and find the argument specious, because this could never have happened with conventional, paper-based mail. Is anyone going to print out 100 extra copies of a letter by accident? Then, by accident, print 100 envelopes with 100 different people's names and lug the pile of envelopes to the mailbox and unknowingly mail all of them? Impossible.

If this message had been sent over America Online, which has an Unsend feature, the embarrassing situation could have been avoided. AOL also has a Save as New feature, which lets you read a message and then put it back in the queue as if it had never been seen.

I have a problem with the dishonesty of this feature. Let's say you send a message to someone who reads it and then places it back by clicking on Unread. When you scan your outbox for a status report, you're told the message was not read—when in fact it was. In real life, on the other hand, you can't unread anything.

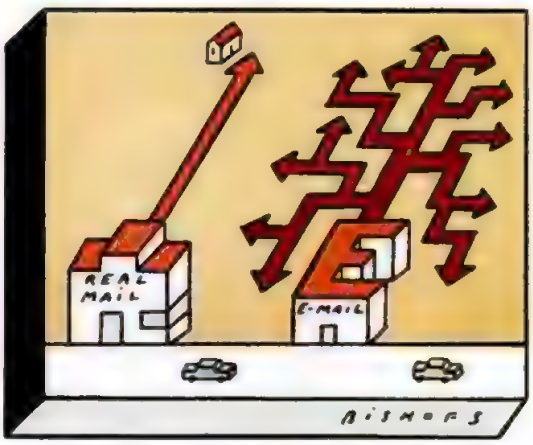
There's a way to do this in MCI Mail, too, but it's more of a bug than a feature. Here's how. You never know if your message was delivered by MCI Mail unless you request a receipt. When you get a receipt attachment from someone with whom you don't want to exchange e-mail and you don't want to let him know that you read his message, you can bypass the receipt system by deleting the message. The receipt notice is never delivered to the sender. Then all you have to do is scan the garbage can and read the message. The sender assumes that the message was never read. It's the electronic equivalent of steaming open a letter.

Though both these tricks defeat the reliable transmission of messages from desktop to desktop, other e-mail features could enhance it. Some bulletin board systems tell you how many times a message was read. Why not extend this feature to e-mail? Imagine getting a receipt from a memo you sent to the boss that says "Message was read twice, forwarded, and discarded."

Also, e-mail systems should hand off some sort of receipt to confirm delivery and to let the sender know for sure that the mail was received in its entirety. Often, I've received half a message with this note at the end: "Message too long for MHS. File truncated." And many messages, especially those I send to Europe, just disappear when they go through a gateway. This information is never communicated to the sender; as far as the sender knows, the e-mail server delivered the entire file.

It's also too easy to hack into e-mail systems. Years ago some industrious but misguided hacker sent me a message on MCI Mail using my own account and my own name. He just wanted to show me how easy it was (for him, maybe) to hack into an e-mail system.

I think it's time to stop pretending that e-mail is as secure or has the same legal protections as mail delivered by the postal service. We need electronic signatures implemented, along with a more reliable reporting trail. And an Unsend feature should be available on all the systems.



Is anyone going to print an extra 100 copies of a letter and unknowingly mail them? Impossible.

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CIRCLE 177 ON READER SERVICE CARD

John C. Dvorak

Inside Track

Comdex Report. The latest Fall Comdex was worse than ever. I have to wonder if the show, with an estimated **195,000 attendees,** is worth the hassle. But I say this every year. And every year I sit in a traffic jam grumbling to myself.

Fall Comdex was marked by a number of ugly trends. There were sprawling, monster-size booths, unimaginable noise levels, corny one-liners, the stench of stale grease, and giant plastic hamburgers.

My **disappointment** was compounded by the decision to stay at the MGM Grand. I really dislike this hotel. The world's biggest hotel, with 5,005 rooms, had little to recommend it. The rooms were okay (the place was brand-new), but the lounges and restaurants were filled with annoying **cheap plastic plants.** Even worse was the fact that the food area was permeated by a stench of stale grease. My advice to the MGM people: See how they do it at the Mirage.

I may be in the minority, though. Some of the hotel guests seemed impressed with the place as they took pictures of themselves in front of a giant plastic hamburger and giant plastic French fries. It was weird. Even more annoying was the obvious edict that all hotel employees must constantly tell you to have a "grand" day. Believe me, that got old fast.

Probably the highlight of my stay was the evening that contributing editor Charles Petzold arrived at the Betty Boop Bar and showed off a **tattoo he had on his right upper bicep.** It depicted the Microsoft Windows logo! Talk about dedication.

The show itself was marked by a number of **ugly trends.** The first was the increased size of the booths. Now they sprawl all over the place, and I do not believe there was one continuous aisle anywhere in the show. The whole scene was a **zig-zagged mess.** Beyond that, the noise level is unimaginable; you have to shout continually if you want to be understood. It's worse in the multimedia areas. Someone should bring in some sound engineers and **baffle the ceiling.** I got a headache every day from the noise.

IBM had a **monstrous** booth with two simultaneous dog and pony shows using animatronics and puppets. Some robot scientist delivered one-liners to what was supposed to be some future woman. She'd say, "The power of OS/2 is much larger, all-encompassing." He'd retort, "Oh, kinda like Rush Limbaugh." Yes, lame. Most of the material was from **George Burns's vault.** Another line: "You want to make my life easier? Put another rest room in this place!"

It was **worse** on the other IBM stage. A guy talked about client/server computing to a Muppet-like image on a TV monitor. Here's some dialog:

Presenter: *That's why IBM offers excellent management solutions, and why we have a special CD-ROM for each of you.*

Puppet: *Hey, don't tell me—IBM's greatest hits! "Am I Blue"? "It's Not Easy Being Blue"? And "Blue Christmas"? And, of course, there's always "Blue Moon"!*

Presenter: *No, this offer is actually a CD-ROM containing the IBM LAN Management collection blah blah blah.*

Sheesh.

Maybe the **biggest booth** was the Motorola booth. It was a monster, and outside, the company had still another booth in the form of a **huge circus tent** filled with PowerPC machines running all sorts of odd applications. The Edsel of computers was a strange-looking black Motorola Power Stack (running Windows NT). Weird-looking. Another huge booth was the one from Digital, which incorporated **a small baseball grandstand!**

I also saw Nokia's colored monitors at Comdex. I love the concept of using a color besides beige, but the colors used here (except for gray) were **gosh-awful.** Somebody told me it was all that was available from the plastic company—a dubious assertion. The problem was that the colors were old-fashioned. The red was actually the same as the Signal Flare Red used by Ford on its 1965 Mustang. Check the calendar! I hope this doesn't deter any vendors from adding color to their equipment.

Other trends at the show included the industry acceptance of the MPEG standard for video. Everyone was using the Sigma MPEG card for video work. This was evident at the Sands convention center, where the multimedia products were gathered. The most dubious trend was **pornography on CD-ROM.** There were hundreds and hundreds of new titles that were nudie movies turned into interactive CD-ROMs. By the way, the promoters of this trend call all this "adult entertainment" and get bent out of shape when you call it porn. Give me a break.

The most interesting product I saw in this genre was the **Mustang Ranch CD-ROM.** I think you can guess what's on that disk! Though I'm no prude regarding these titles, I believe they should have their own show and not be mixed in with the business and developer products. But the show promoters didn't seem to care who displayed at Comdex this year. There was some cleaning company offering free ring cleaning, like what you might see at a country fair. I suspect at this rate we'll have **palm readers and horoscope experts** at Comdex next year. □

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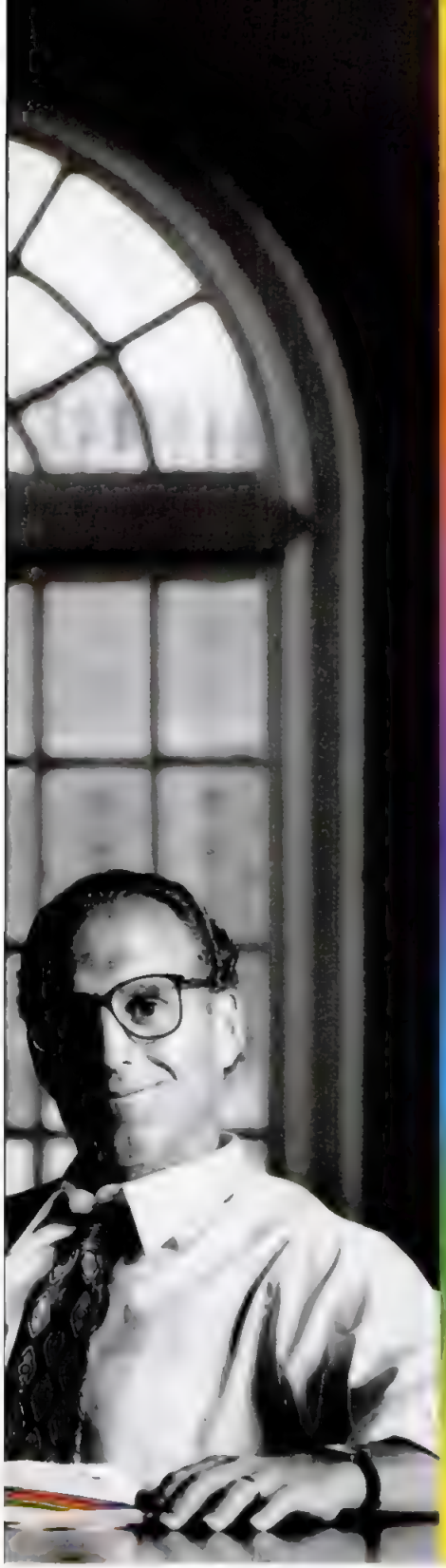

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Jim Seymour

Consumer Software's New Rules

It's Christmas Day. You're sitting at your home computer, surrounded by piles of torn wrapping paper and shreds of shiny ribbon; right in front of you is the towering stack of software packages you gave your kids. Maybe you gave yourself some, too.

Which one to install first? Ah, this one, of course. You read about it here, watched a demo at Computer GaGa before you bought it, and can almost taste the thrill of shooting down those gorgons. You slip the CD-ROM into the drive; type Alt-F, then R, then D:\SETUP; then you sit back and watch it run. Thank heaven for the ease and reliability of CD-ROM software installation. No more shuffling a dozen floppy disks in and out, no more. . . .

Wait a minute. Things seem to have. . .umm. . . stopped. No dialog box, no error message, just. . .silence. You wait a minute. Maybe the PC is just thinking about how to decompress a file, huh? Nothing. You wait about 5 minutes more. Nothing. Time for Ctrl-Alt-Del, and Windows confirms your worst fears: The machine is locked up, the install failed, and you need to hit Ctrl-Alt-Del again.

Welcome to the world of consumer software.

It's not all like that—far from it, in fact. Much consumer software is very good indeed; but in general, consumer software is less stable, and less widely tested with different hardware configurations, than the kind of mainstream Windows and DOS applications business users buy.

The problem is aggravated by the workout that CD-ROM–based multimedia software gives our machines. Sound, more-or-less full-motion video, and the other lovely features of hot multimedia titles test the outer limits of a PC's capabilities as few other programs do—much more than, say, a state-of-the-art word processor would.

THE FUN CONTINUES

Then comes the final straw: You call the software publisher, talk to the technical-support people for a while, and learn that your problem is a Known Bug. Or a "documented incompatibility," in today's latest PC-speak.

And guess what? They're not going to fix it.

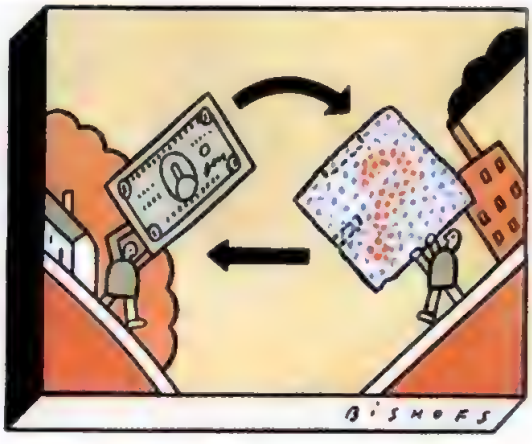
There may be a workaround, but you probably won't like it. "Just create a boot floppy with nothing in the AUTOEXEC.BAT and CONFIG.SYS but your memory manager and path statement." Or "It'll work, but reinstall it with the sound turned off."

My mailbox is full of angry letters these days from buyers of hot new consumer software titles who had problems, called for help, and were told the company knew about the problem but had no plans to fix it till next year when the annual upgrade—which of course they'd be happy to sell you for $25 off—comes out.

Who wants to wait a year to get a working version of a program you just spent 60 bucks for?

This is one of those messes where I understand the vendors' reasoning—and hate it. The villains, of course, are time and money.

When a software vendor gets $20 to $30 for the consumer software package for which you spent $40 to $75, there's not much margin for customer support. Companies spend what they can on technical support—and some do a good job—but the minute the title you just bought "went gold" and passed from the programming team to the people who make the disks and stuff the boxes, that team started work on the next major release. Keep in mind that the consumer software business follows the Dick Francis model: one release a year, probably timed to catch the fourth-quarter holiday buying spree.



Consumer software tends to be less stable and less widely tested than mainstream business applications.

A really fatal bug, which keeps a large percentage of buyers from using a program, may get fixed—or the title may just

Illustration by Maris Bishofs

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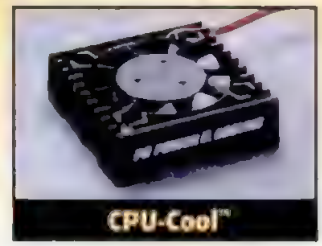

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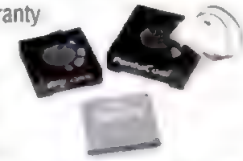

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Jim Seymour

be dropped. But the frenzy to pack in new features and get the next major version out—to say nothing of getting out all the *other* new titles in a company's product line—means there just isn't anyone left to do interim fixes.

Some letter-writers have called this practice criminal, pointing out that it doesn't work that way when Toyota sells you a car: Toyota *has* to make it work, not simply tell you that you're out of luck and offer to sell you next year's model at a discount. But you paid $10,000 or $20,000 for that car, and funds to fix lemons were factored into the sticker price.

DEMAND YOUR RIGHTS

Several readers have asked me to compose a Consumer Software Buyer's Bill of Rights, detailing purchase terms that buyers can demand, *or else*. There's only one such term I think makes sense: a no-questions-asked, satisfaction-guaranteed-or-your-money-back warranty.

Software vendors are starting to catch on. Microsoft has a 90-day refund policy on its home and desktop software. Knowledge Adventure has always offered buyers their money back if the company's great educational software "fails to amaze and delight" them. Some other consumer software publishers—though by no means all of them—have followed the lead of these pioneers. And other companies that don't make an explicit offer will give you a refund if you call up and demand one.

I know that isn't enough. By the time you're ready to demand your money back, you've spent inordinate amounts of time shopping, followed by trying to install, trying to run, and trying to fix the package. Not to mention time on the phone—and maybe on your own nickel.

But we're never going to get those "consequential damages" refunded. A money-back guarantee—without which I won't buy consumer software anymore—is the best we can get. Will you join me, and be vocal about it?

Actually, as any parent knows, the time spent choosing, buying, installing, and trying to fix software isn't the worst part. That comes when you sit there with a three-year-old on your lap, as I have, and he looks up, tears welling in his eyes, and says, "Why can't I see Simba, Dad? Why is it broken? Can't you make it work?" □

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Bill Howard

Mr. PC Goes to Washington

An inevitable side effect of the growth of the personal computer industry is that we're now a large blip on the political radar scope in Washington. In the guise of supporting or "aiding" high technology, you're likely to see the government become more involved, you'll see more guidelines and regulations, and you may see some of the industry's vitality sucked away by the inevitable drain of dealing with Washington.

Some of America's most successful, internationally competitive industries are government-regulated or subsidized, such as farming and education. Some, like the entertainment industry, aren't. And some, like aviation, are in between. The personal computer industry has been more free than fettered, but that's changing.

I'm skeptical of how much the computer industry benefits from the involvement of our government. We've seen incredibly shortsighted policies in the past few years, such as the ban on exports of 386 PCs back when 386s were hot because they might have strategic military value if they fell into the hands of countries hostile to the U.S. interests. All that did was ensure that the U.S. was the only one of the world's several dozen PC-building countries that couldn't export PCs. Then there was the huge import tariff on standalone LCD panels but not on finished portables, which forced Asian laptop builders to close their U.S. assembly facilities and move production back offshore. We saw the boneheaded move by the Patent Office to declare the concept of multimedia the property of a single company. And there was the government's push to implement the Clipper chip.

Some government involvement is relatively benign. Despite low interest in the Energy Star low-power PC program—buyer studies show it's a secondary issue except in some big corporations and P.C. (politically correct) households—it's not tough to do and does have some benefits. To its credit, the PC industry has quietly and quickly developed lower-power PCs, with none of the teeth-gnashing we saw when energy efficiency was forced on the auto industry in the 1970s.

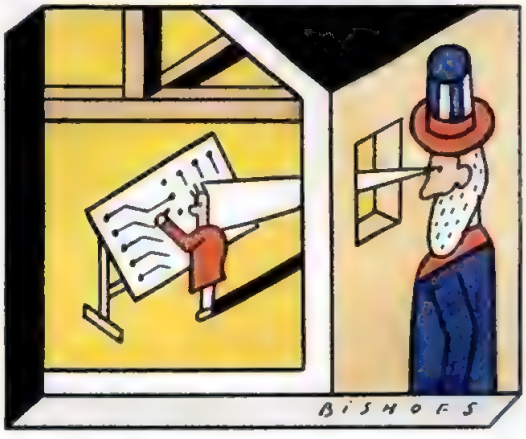
As the industry grows, the biggest companies will be scrutinized for monopolistic practices. The government has an antitrust SWAT team camped on the outskirts of Redmond, waiting to pounce on Microsoft. And Microsoft, for its part, will do two or three incredibly dumb, anticompetitive things each year to keep the Justice Department hounds baying.

We're going to see more government involvement as the PC industry ventures into waters that have been traditionally regulated. For instance, all those radio frequencies you want for your PDA wireless devices are government property, which means you'll want to enlist Washington lobbyists and learn about things like minority set-asides if you're going to compete.

The current administration is committed to the idea of equal electronic access to information for everyone. Two generations ago the rallying cry was "a chicken in every pot." Now it's more like "ISDN in every home."

There's even talk of "information highway food stamps" for people who can't afford on-line charges and who don't want to hike over to the local library to log on there. These IH food stamps would probably have to cover the cost of a free PC in the home, too, since a data line without a PC doesn't do you much good, any more than free cable TV service is useful without a TV attached. You could see this as an extension of the low-cost "lifeline-access" phone service mandated for the indigent. You may want to keep your eye on this one (the information free-for-some way), because while it could be funded out of general revenues (your taxes), it's not uncommon for transfer payments to come from taxes on similar goods and services.

We've done pretty well with hardly any government involvement. Let's hope it stays that way. □



Memo to the folks in Washington: Don't touch what's not broken.

Illustration by Maris Bishofs

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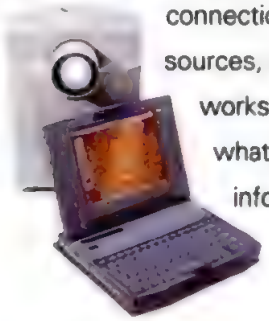

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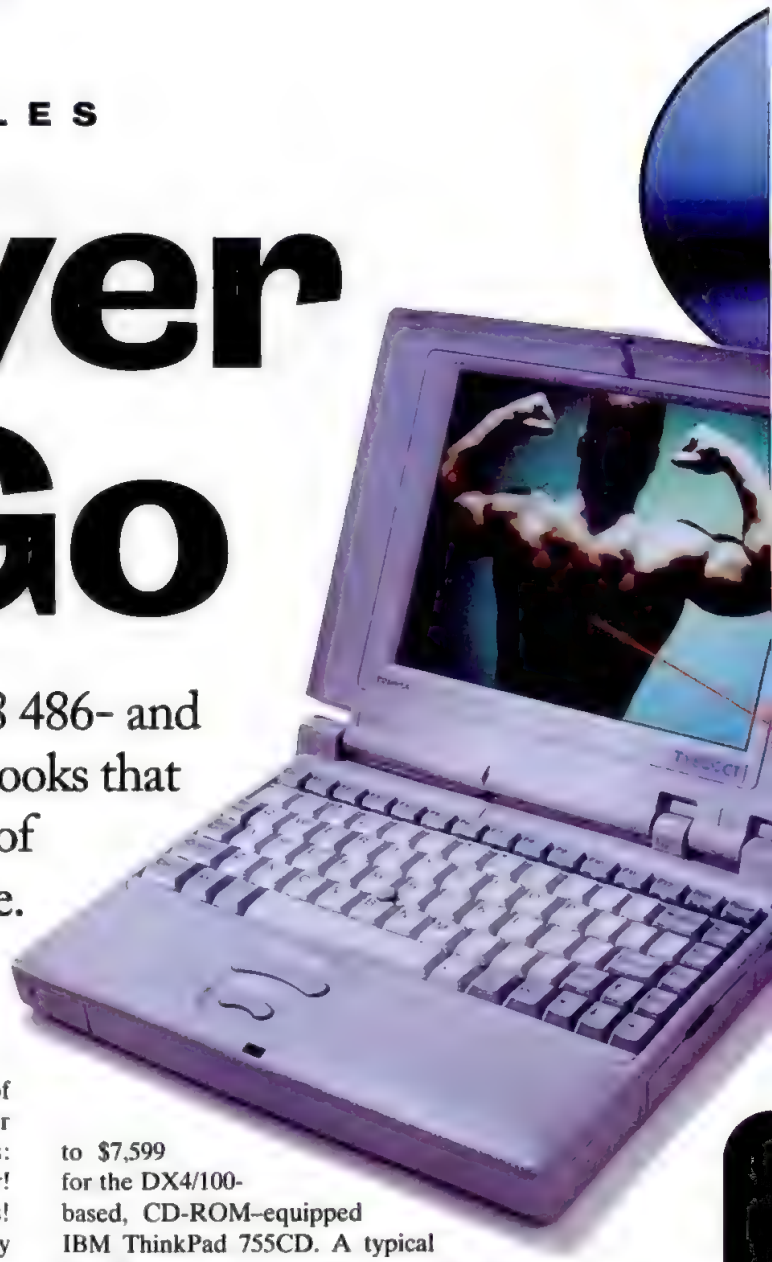
CIRCLE 217 ON READER SERVICE CARD

COLOR PORTABLES

Power To Go

PC Magazine Labs tests 68 486- and Pentium-based color notebooks that set new standards in terms of portability and performance.

By Robert S. Anthony



With each new generation of notebook computers we hear the same old watchwords: Lighter! More processing power! Bigger screen! Brighter colors! Longer battery life! We'd probably be disappointed if we didn't hear them.

But Pentium-powered notebooks? Built-in CD-ROM drives? High-quality stereo sound? Pressure-sensitive pointing devices? It's enough to make you wonder: Who opened the floodgates?

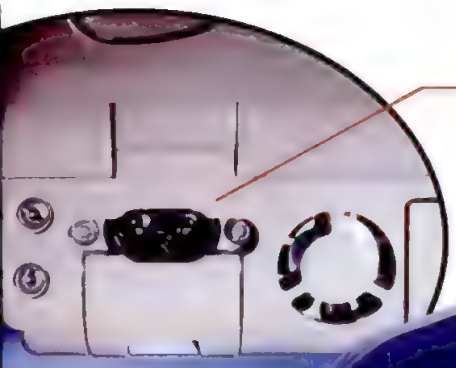
Today's crop of color notebooks and subnotebooks caters to power users who need all the portable processing power they can get their hands on. But don't be fooled. Few of these portables have caught up with top-of-the-line desktop PCs in terms of processing power: The average Windows performance of these notebooks is only half that of a midrange desktop system. Still, the 68 machines we review here have precious little to apologize for.

You'll still pay a premium for portability, though. Prices for the notebooks reviewed here range from $1,699 for CTX International's CTX EzNote 486DX/33 to $7,599 for the DX4/100-based, CD-ROM–equipped IBM ThinkPad 755CD. A typical DX4/75 system with an active-matrix screen will set you back about $5,000; a 486DX2/50 machine with a passive-matrix screen will lighten your wallet to the tune of about $3,000.

REVIEW CRITERIA

For this roundup, we invited notebook manufacturers to submit color notebooks equipped with 486 or faster processors that we had not previously reviewed. Each notebook had to have a travel weight (including system, battery, transformer, and pointing device) of under 9 pounds, although we made exceptions to this limit for CD-ROM–equipped and Pentium-equipped notebooks. The units had to come with a minimum of 8MB of system memory and a hard disk of at least 340MB, unless the largest hard disk available from the manufacturer was

Photography by Thom O'Connor; screen images by Tony Cordoza



Built-in transformer
For greater convenience, Compaq has integrated the AC adapter directly into its LTE Elite series of notebooks, giving you one less piece to carry.

Swappable pointing devices
Customizing notebooks to suit your own style is becoming easier. The WinBook XP 486DX4/100 and 8/520 models offer a choice of pointing devices so you can pick one that you feel comfortable with.

Less is more
Vendors are fitting more and more into smaller packages. The Toshiba Portegé T3600CT features an active-matrix color screen and 4 hours of battery life in an under-6-pound package.

Built-in CD-ROM
CD-ROM drives in notebooks are a reality, making true multimedia on the road possible. You can even choose which loading method you prefer—the IBM ThinkPad 755CD's front-loading unit (shown below) or the Panasonic V-41's flip-up style.

Exchangeable drives
To keep the weight down, IBM's ThinkPad 755CD lets you substitute the CD-ROM drive for the floppy disk drive.

Removable screen
Presentations on the road are now easier than ever. The Aquiline Cruiser offers a detachable screen that you can use with an overhead projector.

What goes into a great notebook PC? Here are half a dozen features worth exploring.

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smaller; the Toshiba Portégé T3600CT subnotebook, for example, can accommodate no more than a 260MB hard disk. (Though hard disks of up to 810MB are available for some of the machines we reviewed for this roundup, the largest model we saw was 689MB; the most common size was 340MB.) DOS and Microsoft Windows or Windows for Workgroups were required, and the units had to be FCC Class B–approved.

CHIPS APLENTY

We ended up with machines representing nearly every 486- and Pentium-class processor available in today's marketplace. We even tested two PCI-based, 90-MHz Pentium notebooks: ARM Computer's ARMNote TS30PS and MidWest Micro's Elite Pentium SoundBook Plus. Three other reviewed notebooks—Aspen Computer's Aspenta 60/66, Broadax Systems' BSI NP3656T Pentium, and FutureTech Systems' FutureMate FM910T—came with 66-MHz Pentium CPUs.

Among the units we tested, the most common processor was Intel Corp.'s DX4/100 processor, which was used in 28 systems. Intel's DX4/75 appeared in 13 units, the 486DX2/50 in 11 units, and the 486DX2/66 in 5 units. There were also a smattering of products using slower CPUs, including Cyrix Cx486DX/33 and Cx486DLC/33 chips.

Keep in mind, however, that this roundup leans toward the top-of-the-line offerings from these vendors. The fact that DX4/100-based machines dominate our reviews hardly means that this level of notebook will dominate the marketplace.

The road to getting a Pentium processor into a notebook has been a long one indeed. The key problem was heat: Intel's original 60-MHz and 66-MHz Pentium CPUs were 5-volt devices which drew about 13 watts of power and generated enough heat to singe a misplaced finger.

HIGHLIGHTS

Color Portables

THESE 68 COLOR NOTEBOOKS and subnotebooks offer everything from lightweight convenience to powerful multimedia presentation capabilities. Their performance doesn't match that of high-end desktops, but the gap is closing. Portability still carries a price premium: The least expensive notebook here costs $1,699, and the most expensive, $7,599.

BATTERY TECHNOLOGY continues to improve, with lithium ion batteries in the lead. Toshiba's lithium ion–equipped Portégé T3600CT ran for nearly 4 hours under intense usage, compared with just over 3 hours for the nickel hydride battery–equipped notebook with the longest life. Expect battery life under less arduous usage to be 1.5 to 2 times longer than our WinDrain results show.

SUBNOTEBOOKS DEMAND FEWER compromises than ever before. The best-of-breed HP OmniBook 600C and Toshiba Portégé T3600CT both have a road weight of about 5 pounds (without a floppy disk drive) and deliver strong performance and sharp graphics.

PENTIUM NOTEBOOKS have arrived, but the first few products are not compelling. They're heavy, short on battery life, and poorly tuned for performance. Our advice: Wait for the coming deluge of Pentium/75-based notebooks, or choose one of the many DX4/100-based notebooks available today.

PORTABLE MULTIMEDIA is becoming a reality as CD-ROM drives debut in three machines: the IBM ThinkPad 755CD, the MPC CD-Book, and the Panasonic V41. If portable presentations are your bread and butter, also consider the Aquiline Cruiser; it has a detachable LCD panel that you can place atop an overhead projector. 8-bit and 16-bit sound is also becoming more commonplace. Over half of the reviewed systems include built-in sound capabilities.

DUAL-SCAN PASSIVE-MATRIX displays approach active-matrix models in clarity and can be as much as $1,000 less expensive. You can expect to see panels with Super VGA resolution and 24-bit color support in coming months.

Full-featured notebook:

- **IBM ThinkPad 755CD**

Subnotebooks:

- **HP OmniBook 600C**
- **Toshiba Portégé T3600CT**

Value notebooks:

- **AST Ascentia 800N**
- **Dell Latitude 450C**

When Dolch Computer Systems introduced a Pentium-based portable PC in 1993, it was considered more of a curiosity than a serious road companion. The Dolch A-PAC 586-60C was about the size of a small piece of luggage, weighed 20 pounds, offered five ISA expansion slots, and used a liquid cooling system. Technically, it could run with batteries, but not for long; it was mostly an AC-powered machine.

With the introduction of the 90-MHz, 100-MHz, and, most recently, 75-MHz Pentium chips, Intel switched to a new 3.3-volt, 0.6-micron design that draws far less power than the 5-volt 60-MHz and 66-MHz Pentiums and generates much less heat. Putting a Pentium CPU in a notebook still takes some engineering, but it's far from impossible. As our testing deadline passed, we saw the first of what will be a deluge of Pentium/75 notebooks in the coming months.

MULTIMEDIA TO GO

The most notable new feature among the notebooks reviewed here is the presence of full-size CD-ROM drives. Although CD-ROM drives are practically standard equipment on new desktop PCs, until recently notebook users who wanted to use CD-ROMs had to contend with external CD-ROM drives.

Panasonic broke new ground in 1993 when it introduced the CF-V21P, the first IBM-compatible notebook system with a built-in CD-ROM drive. Unfortunately, the CF-V21P used 3.5-inch CD-ROM disks instead of the standard 5.25-inch variety. In this roundup, Panasonic is back with the V41—a new notebook with a full-size CD-ROM drive. Panasonic now has competition from the impressive IBM ThinkPad 755CD and from MPC Technologies' MPC CD-Book, both reviewed here; look for even more new CD-ROM–equipped notebooks in the first quarter of 1995.

Putting a CD-ROM drive in a notebook is difficult primarily because of limited real estate. With the Panasonic V41 and the MPC CD-Book, you lift up the keyboard to get to the CD-ROM drive. Panasonic managed to keep a floppy disk drive within its unit; the trade-off is that the V41 has a 9-pound-5-ounce travel weight and a bulkiness that may make you think twice about taking it everywhere you go.

The removable CD-ROM drive in the IBM ThinkPad 755CD is unlike any CD drive you've seen before—and that's precisely the beauty of it. The bottom of the CD-ROM module, which houses the drive mechanism, is about two-thirds the width of the top part, which cradles the CD-ROM disk. This stair-step shape saves internal real estate while adding a minor inconvenience: You have to re-

Our five Editors' Choice notebooks set new standards for features, portability, and value. The undisputed high-end leader is the $7,599 IBM ThinkPad 755CD—a portable PC that's better equipped than many desktop systems. The unit is noteworthy not only for its internal CD-ROM drive, but also for its built-in 14.4-Kbps fax modem, wavetable-synthesis 16-bit stereo sound, and stunningly crisp 10.5-inch screen featuring IBM's new Black Matrix on Array technology. The DX4/100-based, 8-pound-8-ounce (with both floppy disk and CD-ROM drives) IBM ThinkPad is a competitive performer, lasting over 2 hours 30 minutes on our rigorous WinDrain test. If you want similar features but don't need the CD-ROM drive, consider the IBM ThinkPad 755CSE (not reviewed here).

We were amazed by how much was packed into the HP OmniBook 600C ($3,848 estimated street price) and the Toshiba Portégé T3600CT ($4,099 list): They weigh 4 pounds and 4 pounds 8 ounces, respectively, excluding AC adapters and external floppy disk drives.

The 486DX2/50-based Toshiba Portégé, a recent Technical Excellence award winner and successor to the Editors' Choice–winning Toshiba Portégé T3400CT, offers a vibrant active-matrix display and incomparable 4-hour battery life under heavy usage. The trade-off is a keyboard that's 90 percent the size of a standard notebook's.

The HP OmniBook 600C features a speedy DX4/75 CPU, a dual-scan passive-matrix screen, and a battery life of close to 3 hours. We strongly recommend the 260MB hard disk (a $300 option) rather than the 171MB model we tested. But with either the Toshiba Portégé or the HP OmniBook, you can shave off about 10 ounces by leaving the external floppy disk drive at home.

AST's Ascentia 800N ($2,806) and Dell's Latitude 450C ($2,729)—the same 486DX2/50-based machine sold under different names—combine high performance with reasonable prices. Each weighs 6 pounds 8 ounces and has a removable floppy disk drive that can be replaced with a second battery pack to extend the 2-hour battery life.

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move the CD-ROM drive before you can replace the unit's battery.

The MPC CD-Book beats the CD-ROM–equipped machines in price: At $3,158 as configured for this roundup, it's less than half the price of either the IBM ThinkPad 755CD ($7,599) or the Panasonic V41 ($6,599). But the MPC CD-Book was a lackluster performer on our benchmark tests, so it may not be the best candidate for portable multimedia presentations.

Stereo sound has also found its way from desktop PCs into mainstream notebooks. In this story, 41 of the 68 notebooks offer built-in audio subsystems, and many come with built-in microphones. These systems generally offer compatibility with the Creative Labs Sound Blaster and Microsoft Windows Sound System standards and provide jacks for external microphones and speakers. Playing back audio on a notebook won't get you audiophile-quality sound, but for short speech and music clips, it's adequate. If you plan on doing a multimedia presentation in a conference room, though, you should bring along a set of powered speakers.

KEEPING ACTIVE

Notebook buyers have a crucial choice to make when it comes to notebook display technology: the clarity of active-matrix color or the frugality of dual-scan passive-matrix color. Notebooks with monochrome displays (priced at $1,200) have been aimed at those needing maximum battery life and only basic word processing and communications functions.

Active-matrix color screens offer bright, rich colors and can be viewed from wide angles. Dual-scan passive-matrix color displays offer adequately bright and rich colors but nowhere near the viewing angle or sharpness of active-matrix screens. The dual-scan technology is a simple evolutionary step beyond basic passive-matrix screens; it increases the refresh rate of the passive-matrix panel by electronically dividing it into two segments that can be individually addressed. In this roundup, 37 notebooks used active-color displays; 27 used the dual-scan variety.

Only four systems used passive-matrix color screens, although all were ultralightweight notebooks: Compaq Computer Corp.'s Contura Aero 4/33c Model 170 and Contura 400C, ZEOS International's Meridian 400C, and Zenith Data Systems' Z-Lite. In these cases, size reduction was deemed more important than top-of-the-line display technology. But the Toshiba Portégé manages not to compromise on weight or screen technology by squeezing an 8.5-inch active color display into a 3-pound-8-ounce package (system weight). The keyboard was cramped, but it was just large enough for touch typists.

Among machines featured here, the ceiling on graphics is still firmly fixed at VGA (640-by-480) resolution. While new flat-panel technology will bring 800-by-600 resolution and 24-bit color to notebook screens in early 1995, no products with those specifications were shipping in time for this story. (Note, however, that all but eight of these notebooks can generate resolutions of 1,024-by-768 or better on external displays.) Also coming soon are 11- and 11.5-inch displays, up from the 10.4-inch display that's currently the largest available in a mainstream notebook. Because of differences in the way monitor screens are measured, an 11.5-inch panel actually offers a viewing area about equal to that of a 14-inch CRT.

Local-bus graphics subsystems are the

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Suitability to Task: Color Portables

Today's notebooks have taken a big step toward achieving a good balance between power, portability, and premium parts; many offer Pentium power, built-in CD-ROM drives, high-quality stereo sound, and pressure-sensitive pointing devices. Some even integrate fax modems, AC power transformers, and infrared interfaces for file transfers. Ratings in the categories described below will help you decide which notebook is right for you.

Product name	Windows applications	DOS applications	Road warrior	Desktop replacement
Product name	POOR	FAIR	GOOD	EXCELLENT

Windows applications is a demanding category that indicates how well a system operates Microsoft Windows–based software. Factors include Winstone 95, Graphics WinMark 95, and Disk WinMark 95 test scores as well as the system's hard disk options and its diagonal screen size.

The **DOS applications** rating reflects a system's ability to run DOS software. *Excellent* systems are those that earned top PC Bench 9.0 DOSMark scores and that can run memory-intensive applications. The DOSMark score takes into account processor, hard disk, and video performance.

The **road warrior** rating indicates how adequate a portable is as a traveling companion. *Excellent* units are compact and light, have long battery lives, and include large screens, built-in pointing devices, and PCMCIA slots.

The **desktop replacement** rating is important if the portable will be your sole computer both at home and on the road. Here, fast performance is more critical than light weight or long battery life. Optional docking stations or port replicators are a *plus in this* category. A system's maximum supported external resolution is also a factor.

rule rather than the exception in this roundup as notebook vendors continue to improve their systems' graphics performance. Only the two Compaq Contura 400s lacked some type of local-bus graphics. Despite its local-bus graphics subsystem, the best graphics performer here—the Panasonic V41—achieved only about half the Graphics WinMark 95 score of the fastest desktop systems we've seen. It is as fast as many 486DX2/66 and even some Pentium/60 and Pentium/66 machines, though.

BATTERY SHUFFLE

Last year, Duracell International attempted to encourage notebook makers to adopt standard battery sizes by introducing a line of batteries that could be used not only in notebooks, but also in other electronic devices such as cellular phones. If this roundup is any indication, the battery-standardization effort has yet to catch on. We saw a seemingly endless variety of battery shapes and sizes, from the featherweight 10-ounce pack used in the HP OmniBook 600C to the 2-pound battery brick used in the BSI NP3656T Pentium. And we don't expect that to change: Notebook manufacturers don't want to compromise their designs by committing to a fixed battery standard.

Not surprisingly, nickel hydride batteries have almost completely displaced the nickel cadmium variety. Nickel hydride batteries have a higher *power density*—that is, more power in the same mass—than nickel cadmium batteries and don't suffer from the "memory" problem that nickel cadmium batteries can encounter if they're recharged without being fully drained first.

Lithium ion batteries, seen here in the two Dell Latitude XP series notebooks as well as in the Toshiba Portégé, have even higher power densities than nickel hydride batteries. The lithium ion battery–powered Toshiba Portégé posted the best battery life in this roundup at 3 hours 58 minutes on our WinDrain test. The "smart" lithium ion battery pack in the Dell Latitude XP machines has a nifty feature: Press a button and built-in LEDs light up to indicate just how much of a charge is left in the pack. The downsides to lithium ion batteries, for now, are their price (over $200) and their extra-long charge cycles—up to 8 or 10 hours.

Service & Reliability

For our 1995 Service and Reliability survey, we sent questionnaires to 17,000 randomly selected *PC Magazine* subscribers; about half responded. We publish results only for those vendors for which we received at least 50 responses.

Users rated their satisfaction with the overall reliability of each system, with their experiences in repairing the PC, and with the vendor's technical support.

▲ **Significantly above average**
● **Average**
▼ **Significantly below average**

Company	Reliability	Repair	Tech support
AST	▼	●	●
AT&T	●	●	▲
Compaq	▲	▲	▲
Dell	▼	●	●
Everex	●	▼	●
Gateway	▲	▲	▲
Hewlett-Packard	▲	▲	▲
IBM	▲	▲	▲
Texas Instruments	▲	▲	▲
Toshiba	▲	●	●
ZDS	▼	▼	▼
ZEOS	▼	▼	●

NO LOOSE ENDS

Clip-on or snap-on external trackballs, once an obligatory accessory for notebooks, are all but absent from this roundup. Of the 68 systems reviewed, only the Toshiba T4850CT has an external Microsoft BallPoint trackball that you clip on its side. Toshiba's upcoming 4900 series of notebooks will jettison the external trackball in favor of the AccuPoint pointing stick used in the Portégé T3600CT.

Ironically, the most influential notebook pointing-device design comes from a company that doesn't build IBM-compatible PCs: Apple Computer. The basic Apple PowerBook design, which includes a recessed keyboard and a large trackball nestled into a wide wrist-rest area, has been adopted by many of the manufacturers in this roundup. Apple was also the first to introduce the touch pad successfully.

Of the 68 reviewed notebooks, 51 have integrated trackballs and 13 have pointing sticks located within their keyboards. Some notebooks, such as the Gateway ColorBooks and the Mintronix SLic4100, use trackballs that pop out from the front of the unit.

In the NEC-designed AT&T Globalyst 250, the trackball and mouse buttons are placed vertically on the front edge of the system. The two Compaq LTE Elite systems integrate a trackball into the front of their display panels, with mouse buttons on the display's back.

Among the interesting pointing-device designs is that of the MPC CD-Book, which has a unique split Spacebar. The left side operates normally, but the right side is divided into three sections: a rocker-key pointing device and two mouse buttons. The HP OmniBook uses a small, pop-out mouse attached to a flexible strip.

Twinhead Corp. incorporated Cirque Corp.'s GlidePoint technology, which employs a touch-sensitive cursor-control pad, into its Slimnote 5100T. WinBook Computer Corp. will be shipping similar GlidePoint-equipped versions of the products reviewed here by the time you read this.

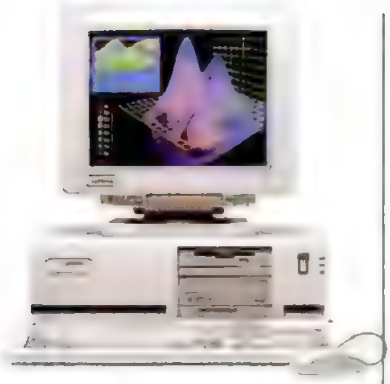
FAVORITE FEATURES

One feature we wish we'd see more often is an integrated fax modem, which appears in only six of the notebooks in this roundup. Many notebook manufacturers argue that building in the fax modem locks you into communications standards that are sure to be superseded, and that it presents regulatory problems outside of the United States. Besides, you can always use a PCMCIA slot. But we disagree: Notebooks are communications devices as much as anything else, and a modem is a near necessity. We are especially fond of IBM's solution, which uses the Mwave DSP chip to power both the wavetable-synthesis audio subsystem and a 14.4-Kbps fax modem. The beauty of a DSP is that, with a simple software upgrade, you can increase the capabilities of the modem and adapt it to new standards. In coming months, you'll see even more notebooks with built-in fax modem capabilities.

In its LTE Elite line, Compaq integrates an AC power transformer right into the notebook. This eliminates the ungainly brick that comes with most units; all that you have to carry is an AC cable virtually identical to the two-wire connector used for electric razors. Though both of the Compaq LTE Elite machines reviewed here weigh less than 7 pounds outfitted for the road, their luster was diminished by poor performance on our benchmark tests.

Infrared interfaces promise to eliminate the cables needed to transfer files from a

How To Economize (Call Compaq D



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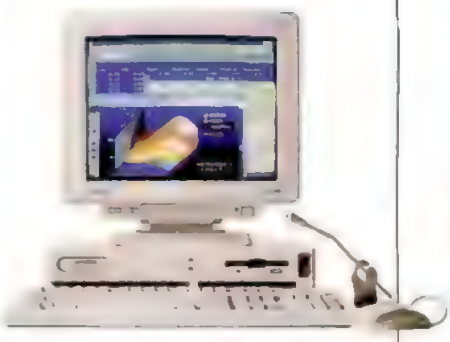

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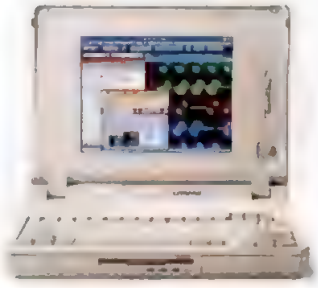
QVision Local Bus Graphics with 1MB VRAM

SVGA Color Monitor (1024 x 768)

Enhanced audio capabilities and Microphone

Preinstalled MS-DOS 6, MS-Windows 3.1, MS-Windows Sound System software, and TabWorks



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LTE Elite Features:

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4MB RAM (expandable to 20MB)

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Two PCMCIA Type II slots (or one Type III)

3.5" 1.44MB Diskette Drive

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- 3.5" External Diskette Drive
- 8" Monochrome Backlit VGA Display
- Integrated Compaq EasyPoint™ Trackball
- PCMCIA Type II slot
- NiMH Battery & AC Adapter
- Preinstalled MS-DOS 6, MS-Windows 3.1, and TabWorks

New Compaq Contura 400C

Contura 400C Features:

- 486DX2/40MHz Processor
- 4MB RAM (expandable to 20MB)
- 250MB Hard Drive
- Two PCMCIA Type II slots (or one Type III)
- 3.5" 1.44MB Diskette Drive
- 8.4" Color Dual Scan Display (Color TFT available)
- Integrated Trackball
- Only 5.9 lbs.
- Preinstalled MS-DOS 6, MS-Windows 3.1, TabWorks, and Lotus Organizer

The new Compaq Contura 400C is an affordable, lightweight color notebook that's packed with practical features such as an integrated centered trackball, convenient wall-mount AC adapter, tilting full-function keyboard, PCMCIA slots, a clip-on carrying handle, and optional docking base.

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desktop system or to connect to printers—a noble goal, but one that isn't exactly driving the market today. The HP OmniBook 600C, IBM ThinkPad 755CD, and the Mid-West Micro Elite Pentium SoundBook Plus were the only reviewed portables with an infrared interface (all are IrDA-compliant). We expect more notebooks and personal digital assistants (PDAs) from major vendors incorporate infrared interfaces over the next year, although widespread acceptance of the technology is probably another year or two away.

COMING SOON

A few notebooks hit the market just too late to be reviewed here. The IBM ThinkPad 360CE and ThinkPad 360CSE, the Digital HiNote, and the ZDS Z-Star EX and Z-Noteflex are covered in the First Looks section of this issue. And Toshiba's new Pentium/75-based T4900CT was reviewed in the First Looks section of our issue of December 6, 1994. NEC Technologies will soon be shipping additional models in its Versa line, including a model with an 800-by-600 active-matrix display and a model supporting 24-bit color; these units were not available in time for this roundup.

AMS Inc.
- **AMS SoundPro DX4/75**
- **AMS SoundPro DX4/100**

Austin Direct
- **Austin Business Audio DX4/100**

Ergo Computing Inc.
- **Ergo PowerBrick 100**

The $3,995 AMS SoundPro DX4/100 and the $2,295 AMS SoundPro DX4/75 from AMS, the $4,615 Business Audio DX4/100 from Austin Direct, and the $4,695 PowerBrick 100 from Ergo Computing all offer built-in audio support as well as crisp displays and decent design. Performance, however, was not particularly strong, and none of these units broke the 2-hour mark on our WinDrain battery test. In addition, the 8-pound travel weights of the three 100-MHz systems may be more than some would like in a traveling companion.

All four notebooks are manufactured by a Taiwanese company, Arima Computer. The SoundPro DX4/75 is the lone 75-MHz system in the group. It has a Hitachi dual-scan passive-matrix display and, at 7 pounds 14 ounces, is the lightest of the group. The SoundPro DX4/100, the PowerBrick (both of which weigh in at 8 pounds 2 ounces), and the Austin DX4/100 (which weighs 8 pounds 4 ounces) all have active-matrix displays—the first two manufactured by NEC, the third from Hitachi.

On our WinDrain test, the Austin DX4/100 lasted only 1 hour 15 minutes; the SoundPro DX4/75 posted the longest time of the group, at 1 hour 47 minutes. The SoundPro DX4/100 came in at 1 hour 46 minutes, and the PowerBrick clocked in at one at 1 hour 45 minutes. With the exception of the Austin DX4/100, all of these systems' drain times were average for their CPU class. Each system lets you recharge the battery while it's in use.

Austin Business Audio DX4/100

	Windows applications	DOS applications	Road warrior	Desktop replacement
AMS SoundPro DX4/75	GOOD	FAIR	GOOD	GOOD
AMS SoundPro DX4/100	GOOD	GOOD	GOOD	GOOD
Austin DX4/100	EXCELLENT	GOOD	FAIR	GOOD
Ergo PowerBrick	GOOD	GOOD	GOOD	EXCELLENT

Performance varied on our benchmark tests, in part because of configuration differences. The two AMS systems and the Austin system used the Western Digital 90C24 graphics accelerator chip set, while the Ergo system used the WD90C24A2. The SoundPro DX4/75 had a 245MB Maxtor hard disk installed; the SoundPro DX4/100 had a 333MB IBM hard disk; the Austin DX4/100 had a 488MB Toshiba disk, and the PowerBrick had a 518MB Toshiba disk. The two AMS systems and the PowerBrick had 8MB of RAM installed; the Austin DX4/100 had 16MB.

Not surprisingly, the Austin DX4/100 was the best performer in this group, with the best Winstone 95 score in this processor range as well as an above-average score on the Graphics WinMark 95 tests. Its Disk WinMark 95 test score was average. The SoundPro DX4/75 posted average Winstone, Graphics WinMark, and Disk WinMark scores. The SoundPro DX4/100 posted an above-average score on the Disk WinMark tests and an average Graphics WinMark score compared with its CPU group, but the unit's Winstone score was below average. The PowerBrick had an average Winstone score, a below-average Disk WinMark score, and an above-average DOS Video score. All other test scores were average.

Each of these systems has integrated 16-bit sound support and external ports for a microphone and speakers. The SoundPro systems also include external speakers. The PowerBrick and the Austin DX4/100 came with an internal 14.4-Kbps fax modem installed, which leaves the two PCMCIA slots open for other uses. AMS offers the internal modem for $150 or a 14.4-Kbps PCMCIA version for $125. A docking station is offered by each company at a varying price: AMS sells one for $245; Austin sells its for $299; and Ergo lets you have it for $295.

Like pricing, service and support vary among these three companies. Ergo offers the most complete package overall with a four-year parts-and-labor warranty that includes one year of on-site service; the company has a technical-support line available Monday through Friday. AMS has a warranty good for three years: parts-and-labor as well as technical support Monday through Saturday, but on-site service is not available. Austin has 24-hour, 7-day technical support, but offers only one year of parts-and-labor and no on-site service.—*William P. Flanagan*

▶ **AMS SoundPro DX4/75, AMS SoundPro DX4/100.** AMS Inc., *Irwindale, CA; 800-886-2671, 818-814-8851; fax, 818-814-0782.*

Circle 444 on reader service card

▶ **Austin Business Audio DX4/100.** Austin Direct, *Austin, TX; 800-483-9938, 512-339-3500; fax, 512-454-1357.*

Circle 450 on reader service card

JetDirect EX External print servers support any parallel-based printer. JetDirect cards support HP LaserJet, HP DeskJet and HP DesignJet printers with I/O slots

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Network compatibility: Ethernet 10Base-T, 10Base2, Token Ring (4/16 Mbps), Apple LocalTalk*

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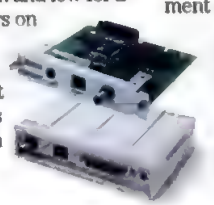

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Battery Life vs. Portability

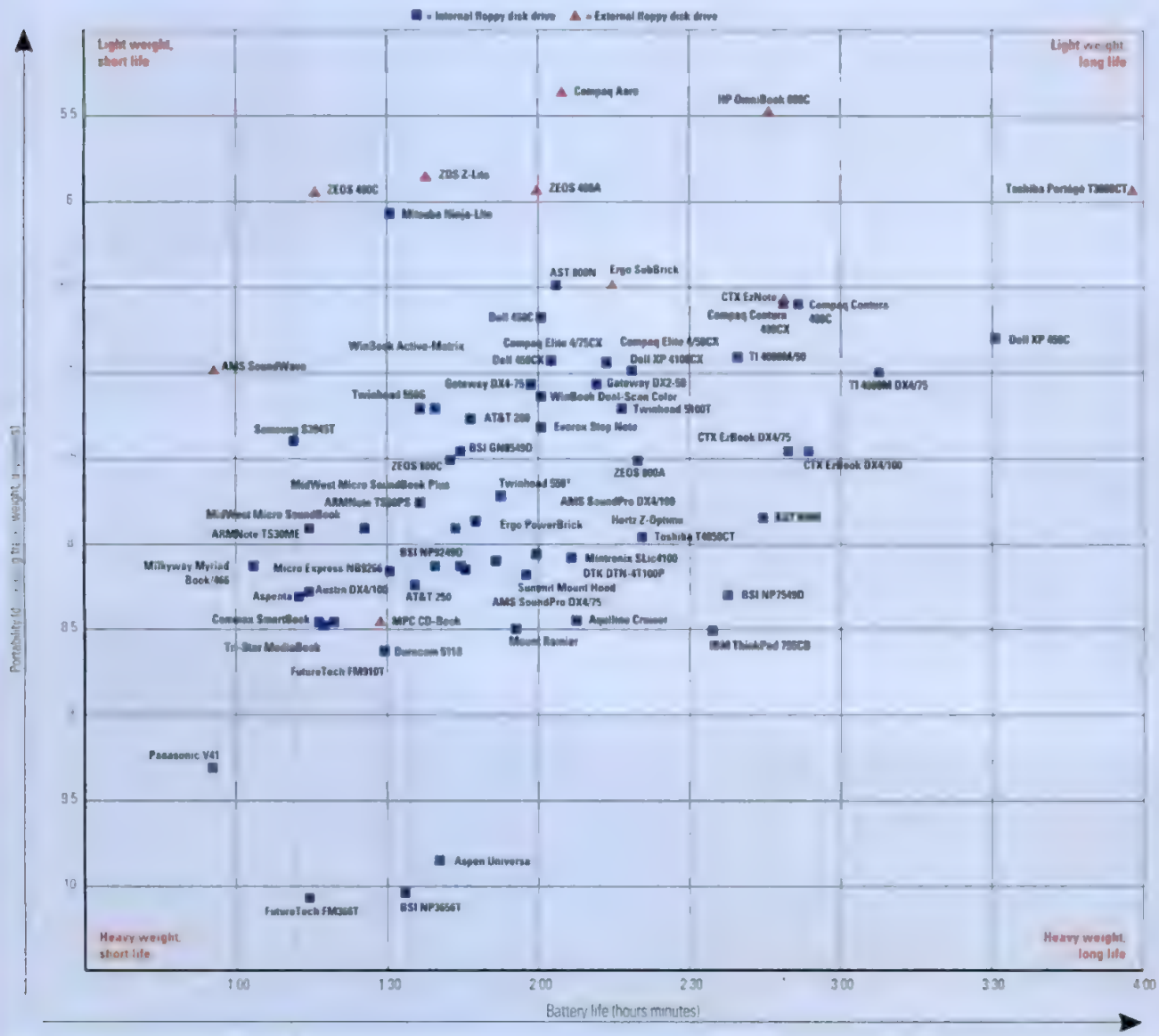
CONTINUES

Battery life leaders are the $4,099 Toshiba Portégé T3600CT (3 hours 58 minutes) and the $2,728 Dell Latitude XP 450C (3 hours 31 minutes). Lithium ion batteries account for these high scores. Only three machines used them: the other was the Dell XP4100C. Only two machines still use nickel cadmium battery packs—the Mintronix SLic4100 ($2,745) and the Milkyway Myriad-Book/466 ($3,395). They lasted only 2 hours 7 minutes and 1 hour 4 minutes, respectively. Nickel hydride batteries power the majority of reviewed notebooks, including the TI TravelMate 4000M DX4/75 Dual Scan ($4,799)—the third-highest scorer at 3 hours 8 minutes.

If the numbers for battery life seem short, it's because we're using a new, heavy-usage battery test called WinDrain. The average DX4/100 system lasted about 1 hour 45 minutes, but we expect you would get 1.5 to 2 times as much life under more typical usage.

The travel weight includes the AC adapter, cord, and any external floppy disk drives (which alone account for 10 to 12 ounces of units' travel weights).

—Analysis written by Mary E. Behr



Battery Life vs. Portability

ENDS

	Travel weight	Battery life (hours: minutes)	Battery weight	Battery life per pound of battery weight (hours: minutes)
AMS SoundPro DX4/75 (DX4/75)	7 lbs 14 oz	1:46	1 lb 7 oz	1:13
AMS SoundPro DX4/100 (DX4/100)	7 lbs 14 oz	1:48	1 lb 8 oz	1:13
AMS SoundWave (DX4/100)	7 lbs	0:56	11 oz.	1:20
Aquilne Cruiser (DX4/75)	8 lbs 7 oz.	2:08	1 lb 6 oz	1:33
ARMNote TS30ME (DX4/100)	7 lbs 14 oz	1:15	1 lb 5 oz.	0:58
ARMNote TS30PS (Pentium/90)	7 lbs 12 oz	1:37	1 lb 5 oz.	1:14
Aspenta (Pentium/66)	9 lbs 13 oz	1:13	1 lb 14 oz	0:38
Aspen Universa (DX4, 100)	8 lbs 5 oz	1:40	12 oz	2:16
AST 800N (486DX2/50)	6 lbs 8 oz	2:04	1 lb	2:04
AST 900N (DX4/75)	7 lbs 13 oz	2:45	1 lb 10 oz	1:43
AT&T 200 (DX4/75)	7 lbs 4 oz.	1:47	13 oz	2:15
AT&T 250 (DX4/75)	8 lbs 4 oz	1:36	1 lb 2 oz	1:24
Austin DX4/100 (DX4/100)	8 lbs 4 oz	1:15	1 lb 7 oz	0:52
BSI GN8549D (DX4/100)	7 lbs 7 oz	1:45	1 lb 4 oz.	1:24
BSI NP3656T (Pentium/66)	10 lbs.	1:34	2 lbs.	0:47
BSI NP7549D (DX4/100)	8 lbs 5 oz.	2:38	1 lb 9 oz.	1:40
BSI NP9249D (DX4/100)	8 lbs 2 oz	1:40	12 oz.	2:16
Commax SmartBook (DX4/100)	8 lbs 7 oz	1:17	12 oz.	1:44
Compaq Contura 400C (486DX2/40)	6 lbs 9 oz	2:52	1 lb	2:48
Compaq Contura 400CX (486DX2/40)	6 lbs 9 oz	2:49	1 lb	2:45
Compaq Aero (486SX/33)	5 lbs 6 oz	2:05	1 lb	2:02
Compaq Elite 4/50CX (486DX2/50)	6 lbs 15 oz	2:14	1 lb 5 oz	1:40
Compaq Elite 4/75CX (DX4/75)	8 lbs 15 oz.	2:14	1 lb 5 oz.	1:40
CTX EzBook DX4/75 (DX4/75)	7 lbs 7 oz	2:50	1 lb 4 oz.	2:18
CTX EzBook DX4/100 (DX4/100)	7 lbs 7 oz	2:54	1 lb 4 oz.	2:21
CTX EzNote (Cyrix Cx486DX-33)	6 lbs 9 oz	2:49	1 lb.	2:50
Dell 450C (486DX2/50)	6 lbs 11 oz.	2:01	15 oz.	2:10
Dell 450CX (486DX2/50)	6 lbs 15 oz.	2:03	15 oz.	2:13
Dell XP 450C (486DX2/50)	6 lbs 13 oz.	3:31	14 oz.	2:41
Dell XP 4100CX (DX4/100)	7 lbs.	2:19	14 oz.	4:02
DTK DTN-4T100P (DX4/100)	8 lbs 1 oz	1:52	1 lb 7 oz	1:17
Duracom 5110 (DX4/100)	8 lbs 10 oz.	1:30	12 oz.	2:03
Ergo PowerBrick (DX4/100)	8 lbs 2 oz	1:45	1 lb 5 oz.	1:21
Ergo SubBrick (Cyrix Cx486DX-33)	6 lbs 8 oz.	2:15	1 lb	2:16

	Travel weight	Battery life (hours: minutes)	Battery weight	Battery life per pound of battery weight (hours: minutes)
Everex Step Note (486DX2/50)	7 lbs 5 oz.	2:01	1 lb 5 oz.	1:33
FutureTech FM366T (Pentium/66)	10 lbs 1 oz	1:15	1 lb 15 oz	0:39
FutureTech FM910T (DX4/100)	8 lbs 7 oz.	1:20	12 oz	1:49
Gateway DX2-50 (486DX2/50)	7 lbs 1 oz	2:12	1 lb 4 oz	1:44
Gateway DX4-75 (DX4/75)	7 lbs 1 oz.	1:59	1 lb 4 oz.	1:34
Hertz Z-Optima (486DX2/66)	8 lbs 1 oz	2:00	1 lb 4 oz.	1:33
HP OmniBook 600C (DX4/75)	5 lbs 7 oz.	2:46	10 oz.	4:19
IBM ThinkPad 755CD (DX4/100)	8 lbs 8 oz	2:35	1 lb 3 oz	2:13
Micro Express NB9266 (486DX2/66)	8 lbs 2 oz.	1:31	1 lb. 8 oz.	1:01
MidWest Micro SoundBook (DX4/100)	7 lbs 14 oz	1:26	1 lb 5 oz	1:06
MidWest Micro SoundBook Plus (Pentium/90)	7 lbs 14 oz	1:44	1 lb. 5 oz.	1:19
Milkyway MyriadBook/466 (486DX2/66)	8 lbs 2 oz	1:04	10 oz.	1:40
Mintronix SLic4100 (DX4/100)	8 lbs. 1 oz	2:07	1 lb. 7 oz.	1:30
Mitsuba Ninja-Lite (486DX2/66)	6 lbs 1 oz.	1:31	13 oz.	1:50
MPC CD-Book (DX4/75)	8 lbs 7 oz.	1:29	1 lb. 2 oz.	1:20
Panasonic V41 (DX4/100)	9 lbs 5 oz	0:50	11 oz.	0:47
Samsung S3945T (DX4/75)	7 lbs. 6 oz.	1:12	1 lb.	1:10
Summit Mount Hood (486DX2/66)	8 lbs 3 oz.	1:58	1 lb 8 oz	1:17
Summit Mount Rainier (DX4/100)	8 lbs. 8 oz.	1:56	1 lb. 8 oz.	1:16
TI 4000M/50 (486DX2/50)	7 lbs	2:40	1 lb 6 oz	1:58
TI 4000M DX4/75 (DX4/75)	6 lbs. 14 oz.	3:08	1 lb. 5 oz.	2:21
Toshiba Portége T3600CT (486DX2/50)	5 lbs 15 oz	3:58	1 lb.	4:02
Toshiba T4850CT (DX4/75)	7 lbs 15 oz.	2:21	1 lb. 5 oz.	1:48
Tri-Star MediaBook (DX4/100)	8 lbs 8 oz	1:18	12 oz.	1:45
Twinhead 550S (486DX2/50)	7 lbs 11 oz.	1:37	1 lb. 3 oz.	1:23
Twinhead 550T (486DX2/50)	7 lbs. 3 oz.	1:53	1 lb 2 oz.	1:42
Twinhead 5100T (DX4/100)	7 lbs 3 oz.	2:17	1 lb.	2:17
WinBook Active-Matrix (DX4/100)	7 lbs 3 oz.	1:40	1 lb 4 oz	1:19
WinBook Dual-Scan Color (DX4/100)	7 lbs 2 oz.	2:01	1 lb 4 oz.	1:36
ZDS Z-Lite (Cyrix Cx486DLC-33)	5 lbs 13 oz	1:38	14 oz.	1:48
ZEOS 400A (DX4/100)	5 lbs 15 oz.	2:00	12 oz.	2:33
ZEOS 400C (DX4/100)	5 lbs 15 oz	1:16	12 oz.	1:37
ZEOS 800A (DX4/100)	7 lbs 8 oz	2:20	1 lb. 6 oz	1:40
ZEOS 800C (DX4/100)	7 lbs 8 oz.	1:43	1 lb 6 oz.	1:13

▶ **Ergo PowerBrick 100.** Ergo Computing Inc., *Peabody, MA; 800-633-1925, 508-535-7510; fax, 508-535-7512.*

Circle 458 on reader service card

AMS Inc.

• AMS SoundWave

The AMS SoundWave subnotebook combines most of the amenities of today's full-size notebooks, such as integrated sound, an active-matrix color screen, and a removable hard disk. Its performance is respectable and so is its $3,695 price. The lack of an integrated floppy disk drive, however, leaves questions about what this full-size notebook wants to be.

The system's display measures 9.5 inches diagonally, which is typical for systems in the DX4/100 processor group. The 7-pound travel weight, which is somewhat heavy for a subnotebook, is relatively light for a full-size laptop. That load can be lightened if the external floppy disk drive is left at home or in the office. An integrated trackball is centered at the base of the keyboard; we found it comfortable to use. There are two PCMCIA slots integrated into the system and they can hold either one Type III card or two Type II cards. The SoundWave also has an internal speaker and ports for an external microphone and speakers.

The system posted uneven scores on our benchmark tests. Its CPUmark$_{16}$ score was average for this processor group, but its Winstone 95 score was below average. With the help of the 333MB IBM hard disk, however, the SoundWave did manage an average score on the Disk WinMark 95 tests. The unit used a Western Digital chip set to control the graphics subsystem, and its Graphics WinMark 95 score was average. As tested, the SoundWave's battery life was barely 1 hour and did not come close to that of some other DX4/100-based systems using nickel hy-

AMS SoundWave

	Windows applications	DOS applications	Road warrior	Desktop replacement
AMS SoundWave	GOOD	GOOD	GOOD	GOOD

dride batteries.—*WPF*

▶ **AMS SoundWave.** AMS Inc., *Irwindale, CA; 800-886-2671, 818-814-8851; fax, 818-814-0782.*

Circle 444 on reader service card

Aquiline Inc.

• Aquiline Cruiser

The $5,995 Aquiline Cruiser is aimed at company trainers and marketing directors who have to give multimedia presentations and seminars. It offers a screen that detaches so you can place it on an overhead projector and a separate, standard fan to dissipate the overhead's heat and prevent damage to the screen. Travel weight is 8 pounds 7 ounces, and the nickel hydride battery lasted just over 2 hours on our WinDrain test, which is a respectable result for this CPU class and battery technology.

The unit came with 16MB of RAM, but performance was somewhat erratic; above-average Winstone 95 and DOS Video scores were countered by below-average scores on the Disk WinMark 95 and Graphics WinMark 95 tests. All other test scores were solidly average.

We tested a DX4/75 unit with a 523MB Toshiba hard disk. The Cruiser is available in 486DX2/66, DX4/75, and DX4/100 MHz versions; the hard disk ranges from 120MB to 810MB. A docking station is available for $595, and a TV tuner for $595.

The Cruiser is neatly laid out. On the right is a floppy disk drive and two Type II PCMCIA slots that can be used as one Type III slot. The hard disk and battery are on the left. The only drawback is a small active-matrix screen (8.5-inch diagonal) that was otherwise clear and easy to read. Built-in speakers are above the keyboard.

Aquiline offers a five-year parts-and-labor warranty. There is also a 60-day money-back guarantee. On-site service costs $200 for one year or $299 for 5 years.—*Mary E. Behr*

▶ **Aquiline Cruiser.** Aquiline Inc., *Troy, NY; 800-370-3322, 518-272-0421; fax, 518-272-0547.*

Circle 445 on reader service card

Aquiline Cruiser

	Windows applications	DOS applications	Road warrior	Desktop replacement
Aquiline Cruiser	GOOD	GOOD	GOOD	GOOD

ARM Computer Inc.

• ARMNote TS30ME

MidWest Micro

• MidWest Micro Elite DX4-100 SoundBook

Full Power Investment has put together a well-designed notebook for ARM Computer and MidWest Micro. The $4,449 ARMNote TS30ME and the $3,999 MidWest Micro Elite DX4-100 SoundBook are impressive DX4/100-based systems in terms of performance and integrated features. The units' short battery life—neither system reached 90 minutes on our WinDrain test—limits their usability somewhat.

These systems are identical in almost every way. Ready to travel, they both weigh 7 pounds 14 ounces. Both use 9.5-inch active-matrix displays; the TS30ME's is manufactured by NEC, and the SoundBook's is manufactured by Hitachi. Both systems integrate a Chips & Technologies graphics accelerator chip set that can handle external resolutions of up to 1,280 by 1,024 pixels. The units' integrated trackballs were centered below the keyboard and set back so that your hands could rest easily on the base of the system. System memory is user-upgradable to 20MB, which was installed on ARM Computer's system for our tests. The tested SoundBook had 12MB of RAM installed.

Each system also uses a nickel hydride battery. On our WinDrain test, the systems did not last very long compared with similar systems: The TS30ME lasted just 1 hour 15 minutes, and the SoundBook lasted 1 hour 26 minutes.

On our benchmark tests, the story was quite different. Both units posted Winstone 95 scores that were among the best in this CPU group, mainly because of their extra memory—the majority of DX4/100 units tested had 8MB of RAM. The SoundBook posted above-average Disk WinMark 95 and average Graphics WinMark 95 scores. The TS30ME, despite using the same 525MB IBM hard disk that the MidWest Micro unit did, posted a Disk WinMark score that was below average. The discrepancy is likely due to the SoundBook's use of Windows for Workgroups (the TS30ME ran Windows 3.1). On the Graphics WinMark tests, the ARMNote's score was average.

MidWest Micro offers a one-year parts-and-labor warranty. ARM's warranty includes one year of parts coverage and three years labor. Neither company offers on-site service as part of the standard warranty, though ARM offers it as a four-year option for $279.—*WPF*

ARMNote TS30ME

	Windows applications	DOS applications	Road warrior	Desktop replacement
ARMNote TS30ME	EXCELLENT	GOOD	FAIR	GOOD
MidWest Micro SoundBook	EXCELLENT	GOOD	FAIR	GOOD

▶ **ARMNote TS30ME.** ARM Computer Inc., *San Jose, CA; 800-765-1767, 408-428-9800; fax, 408-428-9528.*

Circle 446 on reader service card

▶ **MidWest Micro Elite DX4-100 SoundBook.** MidWest Micro, *Fletcher, OH; 800-728-8582, 513-368-2309; fax, 800-562-6622.*

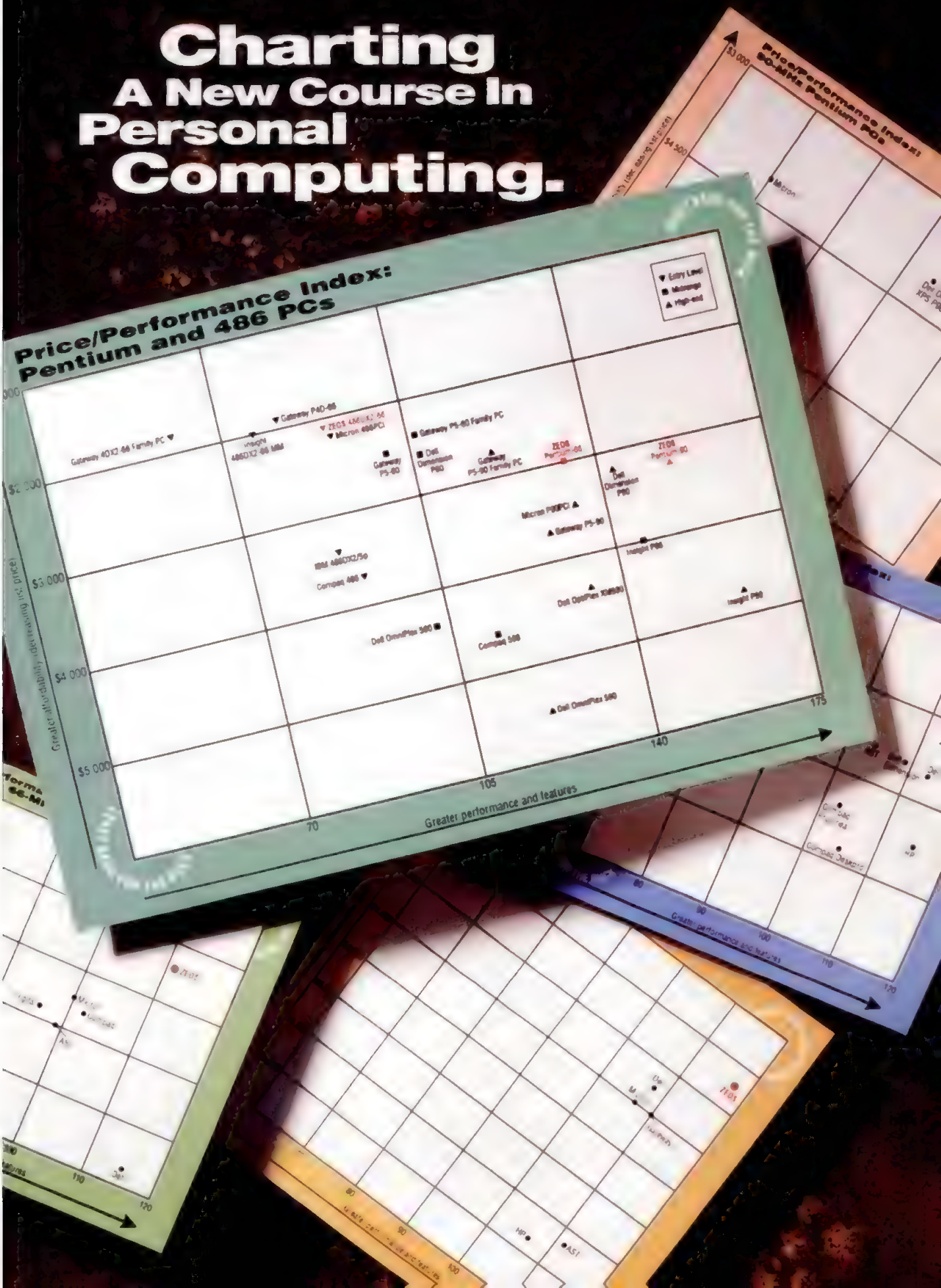
Circle 466 on reader service card

ARM Computer Inc.

• ARMNote TS30PS

The $4,599 ARMNote TS30PS, a dual-scan color notebook from ARM Computer, is one of two 90-MHz Pentium systems in this roundup. Unfortunately, you won't get the performance you'd want from a

Charting A New Course In Personal Computing.



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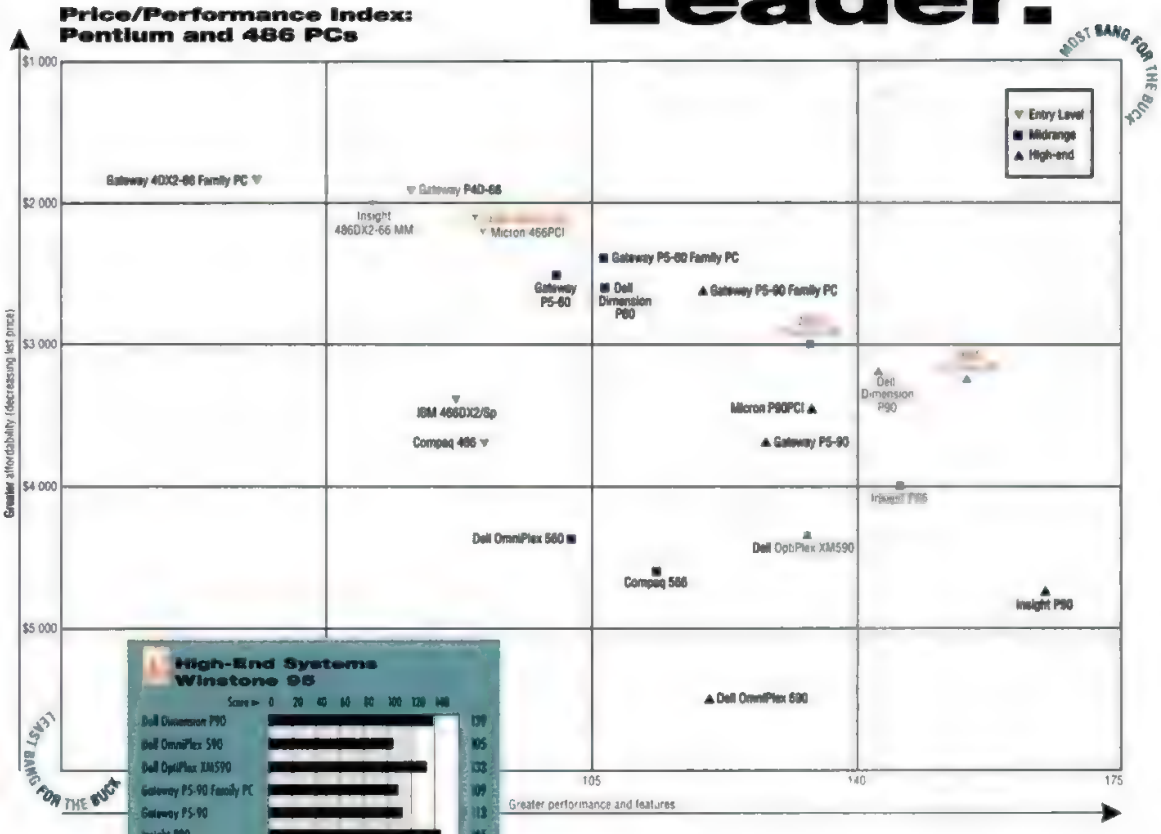

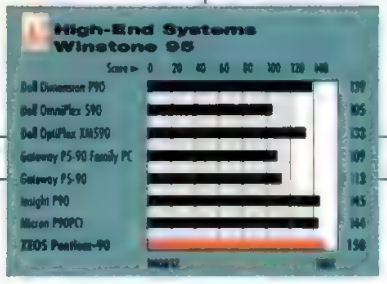

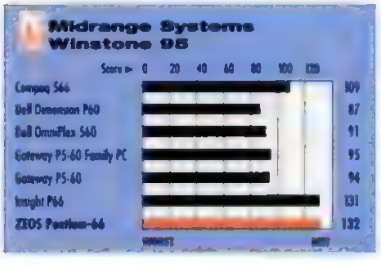

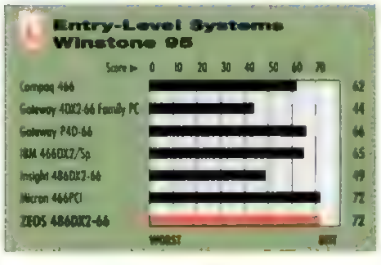

Reprinted from *PC Magazine*, December 6, 1994

"The ZEOS Pantera Pentium-90 was the top performer overall; the other two ZEOS systems—the ZEOS Pantera Pentium-66 and the ZEOS Pantera 486DX2-66—were also leaders in the midrange and entry-level tiers.... A major factor in the Pantera units' success was the outstanding Winstone 95 scores: The Pentium machines produced first-place scores in their respective tiers, and the ZEOS 486DX2-66 earned a top-five ranking among the entry-level systems."

—PC Magazine, December 6, 1994

Package 1		Package 2		Package 3		Package 4	
486DX2-50	$1395	486DX2-50	$1695	486DX2-50	$2195	486DX2-50	$2595
486DX2-66	$1445	486DX2-66	$1745	486DX2-66	$2245	486DX2-66	$2645
DX4-100	$1795	DX4-100	$2095	DX4-100	$2595	DX4-100	$2995
Pentium-60	$1795	Pentium-60	$2095	Pentium-60	$2595	Pentium-60	$2995
Pentium-66	$1945	Pentium-66	$2245	Pentium-66	$2745	Pentium-66	$3145
Pentium-90	$2095	Pentium-90	$2395	Pentium-90	$2895	Pentium-90	$3295
Pentium-100	$2495	Pentium-100	$2795	Pentium-100	$3295	Pentium-100	$3695
➤ 4MB RAM		➤ 8MB RAM		➤ 16MB RAM		➤ 24MB RAM	
➤ 340MB local bus IDE hard drive with 120K cache		➤ 528MB local bus IDE hard drive with 256K cache		➤ 720MB local bus IDE hard drive with 128K cache		➤ 1GB local bus IDE hard drive with 256K cache	
➤ 3.5" 1.44MB floppy disk drive		➤ 2X CD-ROM drive and 3.5" 1.44MB floppy drive		➤ **4X CD-ROM** drive and 3.5" 1.44MB floppy drive		➤ **4X CD-ROM** drive and 3.5" 1.44MB floppy drive	
➤ **Diamond Stealth 64-bit** PCI local bus SVGA color graphics card with 1MB DRAM		➤ **Diamond Stealth 64-bit** PCI local bus SVGA color graphics card with 1MB DRAM		➤ **Diamond Stealth 64-bit** PCI local bus SVGA color graphics card with 1MB DRAM		➤ **Diamond Stealth 64-bit** PCI local bus SVGA color graphics card with 1MB DRAM	
➤ ZEOS 14" 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch		➤ ZEOS 14" 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch		➤ **ZEOS 15"** 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch		➤ **ZEOS 15"** 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch	
➤ Six-bay desktop case with two cooling fans		➤ Six-bay desktop case with two cooling fans		➤ Six-bay desktop case with two cooling fans		➤ Six-bay desktop case with two cooling fans	
➤ Microsoft Mouse		➤ Microsoft Mouse		➤ Microsoft Mouse		➤ Microsoft Mouse	
➤ MS-DOS 6.2, Windows for Workgroups 3.11		➤ MS-DOS 6.2, Windows for Workgroups 3.11		➤ MS-DOS 6.2, Windows for Workgroups 3.11		➤ MS-DOS 6.2, Windows for Workgroups 3.11	
				➤ **Lotus SmartSuite**		➤ **Lotus SmartSuite**	

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Pentium™ 90 & 100 Extras:

- ➤ RAM expandable to 192MB.
- ➤ Integrated business audio.
- ➤ On-board PCI local bus Fast SCSI-2 and Ethernet LAN options.
- ➤ EPA Energy Star compliant (Pentium-90).

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Favorite Options

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Fastest 64-bit accelerated video $249

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ZEOS SVGA NI, 1280 x 1024, flat screen ...$345

SCSI Controller Chip
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32-bit PCI Ethernet LAN adapter. 10Base5, 10Base2 and 10BaseT connections.....$199

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80 to 250MB (with compression), includes backup software $149

Multimedia Upgrade
Turtle Beach sound card and stereo speakers.....$128

10-Bay Vertical Case $95

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Folded edge of the page

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
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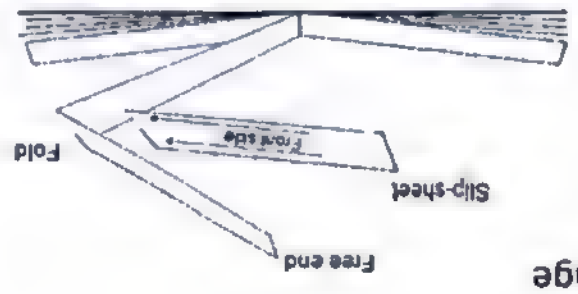
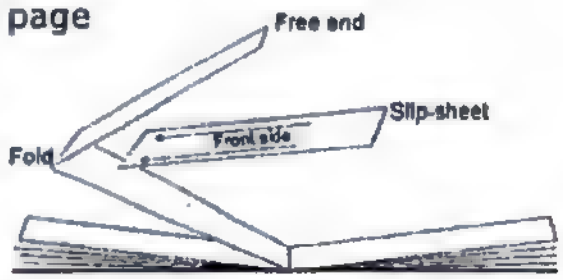
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Back

1. Follow instructions on the other side

GbsFlipBack-001B

Back

1. Follow instructions on the other side

ZEOS® Gives You The Biggest Bang For Your Buck.

PC MAGAZINE EDITORS' CHOICE
Pentium-66
April 12, 1994
DX4-100
June 28, 1994

COMPUTER SHOPPER
Pentium-60
April 1994
Pentium-90
August 1994

PC WORLD BEST
486DX2-66
January 1994
February 1994
March 1994
June 1994
December 1994
January 1995
DX4-100
October 1994
November 1994
December 1994
January 1995
Pentium-60
December 1994
January 1995
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June 1994
July 1994
August 1994
September 1994
Pentium-90
August 1994
September 1994
October 1994
November 1994
January 1995

PC Computing BEST
Pentium-66
May 1994

Windows Sources EXPERTS' PICK
Pentium-66
June 1994
Pentium-90
August 1994

WINDOWS MAGAZINE 1994 RECOMMENDED
Pentium-90
November 1994

1994 W 100
486DX2-66
March 1994

Time after time, the ZEOS Pantera has been tested against the competition, repeatedly beating all others hands down. In *PC Magazine*'s price and performance comparisons of technologically-advanced systems from primary computer companies, ZEOS is once again the unbeatable value.

Unmatched in its success, the Pantera is earning award after award–month after month. To date, the Pantera has received an unparalleled 30 top honors from leading industry publications! Experts agree that the ZEOS Pantera provides you with the biggest bang for your buck.

PC Magazine reported: "Overall performance leaders...the Pantera line has a lot to offer–strong performance at a reasonable price, with excellent documentation."

As *Computer Shopper* said: "ZEOS set the standard."

Continuing with the ZEOS tradition of providing you with top performance, unwavering reliability and exceptional value, the ZEOS Pantera is charting a new course in personal computing for you.

Chart-Topping Performance

The Pantera–based on Intel's 486, DX4 and Pentium processors–is at the top of the performance charts, breaking records and beating all others. Why? Superior engineering built into each Pantera–beginning with a ZEOS-designed motherboard created specifically to take full advantage of the latest technological advancements. The motherboard is stocked with exceptional features such as an on-board PCI Local Bus IDE Controller and support for up to four IDE devices. For the fastest video performance, every Pantera comes with a Diamond Stealth 64-bit PCI video card with 1MB DRAM *standard*.

The results are unparalleled. "Mark a new high on the performance chart!" *PC World* said the Pentium-66 and Pentium-90 Pantera PCs were "the fastest system(s) ever tested." The Pantera 60 also earned a Best Buy in December and January because of an affordable price and "performance that's more representative of a quick Pentium-66 than of the installed Pentium-60."

The Pantera 66MHz and 90MHz received the highest scores in all benchmark tests run by *Windows Sources* too: "The clear winner is the ZEOS Pantera."

All Points Covered

The Pantera is a first-rate example of ZEOS' commitment to provide you with an excellent value on an award-winning machine that will increase your productivity. With all the extras, options, and 100% compatibility with all major operating systems, you can't go wrong.

yes It runs with NetWare

Many of our most popular money-saving Pantera packages are ready to ship *the same day you order.* We also give you the option to custom-design a system to your exact computing needs.

Either way, you can buy with confidence because of our on-going dedication to provide you high-quality features and state-of-the-art technology at an affordable price.

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486DX2-66 $1745
Pentium-60 $2095

Package #2:

- 8MB RAM
- 528MB local bus IDE hard drive
- 2X CD-ROM drive, 3.5" 1.44MB FDD
- Diamond Stealth 64-bit PCI local bus SVGA graphics card with 1MB DRAM
- 14" SVGA color monitor
- 6-bay desktop case
- MS-DOS, Windows for Workgroups, Microsoft Mouse

486DX2-66 $2195

Top Gun:

The above system modified to include:

- 128K SRAM cache
- Diamond Stealth 64-bit PCI local bus graphics card with 2MB VRAM
- 15" SVGA color monitor upgrade
- 14.4/14.4 send/receive fax modem
- Lotus SmartSuite

486DX2-66 $1245

Package #1:

- 4MB RAM, 128K SRAM cache
- 340MB hard drive
- 3.5" 1.44MB floppy drive
- VESA local bus SVGA color video
- 14" SVGA color monitor
- 4-bay desktop case
- MS-DOS, Windows for Workgroups, Microsoft Mouse

Pentium-66 $2845
Pentium-90 $2995

Editors' Choice:

- 16MB RAM, 256K SRAM cache
- 528MB local bus IDE hard drive
- 4X CD-ROM drive, 3.5" 1.44MB FDD
- Diamond Stealth 64-bit PCI local bus graphics card with 2MB VRAM upgrade
- 15" SVGA color monitor
- 6-bay desktop case
- MS-DOS, Windows for Workgroups, Microsoft Mouse
- Lotus SmartSuite

Pentium-66 $2995
Pentium-90 $3195

Hottest Pantera:

The above system modified to include:

- 1GB local bus IDE hard drive
- 6-bay desktop case (Pentium-66) 10-bay vertical case (Pentium-90)

DX4-100 $2995

Package #3:

- 8MB RAM
- 350MB IDE hard drive
- External 3.5" 1.44MB floppy drive
- STN color VGA 7.9" display
- Custom carrying case
- Extra battery
- MS-DOS, Windows for Workgroups
- Lotus Organizer
- 7.8" x 10.2" x 1.7"; 3.9 lbs.

Pentium-66 $3318
Pentium-90 $3468

Best MM:

- 16MB RAM, 256K SRAM cache
- 528MB local bus IDE hard drive
- 4X CD-ROM drive, 3.5" 1.44MB FDD
- 16-bit sound card, stereo speakers
- Diamond Stealth 64-bit PCI local bus graphics card with 2MB VRAM upgrade
- 17" SVGA color monitor
- 10-bay vertical case
- MS-DOS, Windows for Workgroups, Microsoft Mouse
- Lotus SmartSuite

Pentium-90 $3895

Best MM Supreme:

The above system modified to include:

- 24MB RAM
- 1GB local bus IDE hard drive
- 4X CD-ROM drive, 3.5" 1.44MB FDD
- Altec Lansing high-power speakers

DX4-100 $3195

Package #3:

- 8MB RAM
- 350MB IDE hard drive
- Internal 3.5" 1.44MB floppy drive
- Dual-scan color VGA 10.3" display
- Custom carrying case
- Extra battery
- MS-DOS, Windows for Workgroups
- Lotus Organizer
- 8.9" x 11.7" x 1.9"; 6.3 lbs.

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PKN-PCM-9501B

CIRCLE 155 ON READER SERVICE CARD.

Pentium/90; several systems with slower processors (including the DX4/100-based ARMNote TS30ME, reviewed separately) scored significantly better on our Winstone 95 tests than the TS30PS.

ARM markets its TS30PS to business users. Though our tested unit had a 250MB hard disk, a 540MB or 720MB hard disk is now a more popular configuration (ARM didn't have these drives available at the time of testing). The TS30PS also has 16-bit stereo sound and a built-in microphone.

ARM seems to handle heat dissipation, a potential concern with Pentium notebooks, well. The TS30PS stays cool with just a ceramic tile heat sink and cooling vents around the CPU. The absence of an active cooling agent (such as a fan) means the notebook is quieter and there's one less component to drain the system's battery—a good thing, since the TS30PS ran for a short 1 hour 37 minutes on our WinDrain battery test.

For a Pentium/90 notebook, the TS30PS had disappointing performance scores. Despite its 24MB of RAM and 256K L2 cache, its Winstone 95 score was lower than that of some DX4/100-based notebooks in this roundup, and about half the average score for Pentium/90-based desktop systems. The culprit here was the hard disk subsystem. This unit uses a new PCI/IDE hard disk, and its drivers had compatibility problems. It's likely that once these problems are ironed out, the TS30PS's performance will improve dramatically.—*Jodi L. Wynblatt*

ARMNote TS30PS

	Windows applications	DOS applications	Road warrior	Desktop replacement
ARMNote TS30PS	GOOD	GOOD	GOOD	EXCELLENT

▶ **ARMNote TS30PS.** ARM Computer Inc., *San Jose, CA; 800-765-1767, 408-428-9800; fax, 408-428-9528.*

Circle 446 on reader service card

Aspen Computer Inc.
- **Aspenta 60/66**

Broadax Systems Inc.
- **BSI NP3656T Pentium**

FutureTech Systems Inc.
- **FutureTech FutureMate FM366T**

The $4,220 Aspenta 60/66, the $3,545 BSI NP3656T Pentium, and the $4,583 FutureTech FutureMate FM366T are all Pentium/66 notebooks manufactured by Nan Tan Computer of Taiwan. These units do offer some nice extras such as built-in sound and full-size keyboards. But their performance on our tests was mainly average (except the FutureTech unit's strong Winstone 95 score). Furthermore, their hefty travel weights (from 9 pounds 13 ounces to 10 pounds) and relatively short battery times on our WinDrain test (from 1 hour 15 minutes to 1 hour 40 minutes) make them questionable road companions.

All systems came with a 9.5-inch active-matrix screens and speakers embedded on either side of the case below the display. Each unit has a full-size keyboard with a ventilation area above. A large wrist rest and trackball occupy the space below. On the right side of the case, you'll find a 3.5-inch floppy disk drive, one Type III PCMCIA slot, and the NiMH battery. On the left side is the removable hard disk; the Aspen and BSI systems come with about 340MB of hard disk space, while the FM366T came with a 528MB disk. There is also a Type II PCMCIA slot on the left, as well as a microphone and speaker jacks.

These Pentium/66-based machines all produced closely matched scores on the CPUmark$_{16}$ test and close scores on the Graphics WinMark 95 and DOS Video tests. Though these are Pentium machines, their Graphics WinMark and DOS Video test scores were still below the average for DX4/100-based machines in this roundup. On the Disk WinMark 95 tests, the Aspen system produced a score below that of the two others and also below the average even for DX4/100 systems. The BSI unit's score was above average on the Disk WinMark tests, and the FM366T's was average compared with Pentium/66- and DX4/100-based systems. The BSI unit had Windows for Workgroups installed (the others used Windows 3.1), so it could take advantage of WFWG's 32-bit file access capability. On the Winstone 95 tests, the Aspen and the BSI systems' scores were average, while the FutureTech unit—equipped with 16MB of RAM compared with the other two units' 8MB—leapt to an above-average score.

Aspenta 60/66

	Windows applications	DOS applications	Road warrior	Desktop replacement
Aspenta	GOOD	EXCELLENT	FAIR	EXCELLENT
BSI NP3656T Pentium	GOOD	EXCELLENT	GOOD	GOOD
FutureTech FM366T	EXCELLENT	EXCELLENT	FAIR	EXCELLENT

Aspen Computer targets the Aspenta to power users. System memory is upgradable to 40MB, and the largest hard disk available is an 810MB model. Aspen expects to offer a 10.3-inch screen as well as Pentium/75 and 90-MHz versions of its system by the time you read this. The 3.3-volt chip will lower the system weight to 6 pounds 6 ounces. A docking station is also available for $550.

Broadax Systems also markets to power users and offers this machine in 60- and 66-MHz Pentium versions, with an active-matrix or dual-scan display. The vendor has no plans to introduce systems with bigger screens or larger hard disks. BSI has a docking station option for $465.

FutureTech Systems targets the high-end user with the FM366T. The vendor plans to offer an 800MB hard disk by our publication date as well as a 11.3-inch dual-

Price/Performance Index: *Color Portables*

Though not stellar performers, the CTX EzNote 486DX/33, the ZDS Z-Lite, and the Compaq Contura Aero 4/33c Model 170 top the value list because of their low price and light weight. CTX's system is the heaviest of the three, with a 6-pound-9-ounce travel weight. It also boasts the lowest price in our roundup—$1,699, followed by the ZDS Z-Lite ($2,128) and the Compaq Aero ($2,147).

Not surprisingly, the full-featured multimedia notebooks appear at the high end of the price spectrum. At $7,599, the Editors' Choice–winning IBM ThinkPad 755CD was the most expensive notebook of the group. It had a fourth-place performance/features score but its price placed it nearly last because of its lack of affordability. The Panasonic V41 is not too far behind the IBM ThinkPad in terms of performance and features though it is $1,000 cheaper.

For a good value in a full-size notebook, check out the Micro Express NB9266, the BSI NP7549D, the BSI NP9249D, and the AMS SoundPro DX4/75. Prices range from $2,295 to $2,745 and include built-in audio and a 14.4-Kbps fax modem (except for the AMS unit, on which it is a $150 option).

—Analysis written by Jodi L. Wynblatt

THE DATA POINTS

Benchmark test scores account for 40 percent of each system's performance/features score. Most of this reflects Windows-based test results; 10 percent goes to the system's WinDrain score, 10 percent to screen type, and 5 percent to travel weight. Such features as length and type of warranty, component modularity (such as interchangeable floppy disk drive and second battery and removable hard disk), and expandability account for the remaining 35 percent. For more information, look in the Hardware Library of the Editorial Forum on PC MagNet under 14BANG.XLS.

scan screen; a 10.3-inch dual-scan display is currently the largest offered. FutureTech will be introducing a Pentium/90 machine by publication that will be lighter than the machine we reviewed, while still using the same case. There is a docking station available for $480.—*MEB*

▶ **Aspenta 60/66.** Aspen Computer Inc., *Buffalo, NY; 800-472-3273, 716-626-0315; fax, 716-626-1541.*

Circle 447 on reader service card

▶ **BSI NP3656T Pentium.** Broadax Systems Inc., *El Monte, CA; 800-872-4547, 818-442-0020; fax, 818-442-4527.*

Circle 451 on reader service card

▶ **FutureTech FutureMate FM366T.** FutureTech Systems Inc., *Hackensack, NY; 800-275-4414, 201-488-4414; fax, 201-488-4405.*

Circle 460 on reader service card

Aspen Computer Inc.
• **Aspen Universa-E Series**
Broadax Systems Inc.
• **BSI NP9249D**
Commax Technologies Inc.
• **Commax SmartBook III**
Duracom Computer Systems
• **Duracom 5110**
FutureTech Systems Inc.
• **FutureTech FutureMate FM910T**
Micro Express
• **Micro Express NB9266**
Milkyway Computer Products
• **Milkyway MyriadBook/466**
Tri-Star Computer
• **Tri-Star MediaBook**

With the demand for competitively priced notebooks with quality audio features on the rise, eight vendors have turned to Nan Tan Computer of Taiwan to put together units to meet this need. While the eight versions of this somewhat thick and hefty notebook offer middle-of-the-road performance and only adequate battery life, the basic unit does offer a handful of desirable features, such as extra room for large PCMCIA devices.

This group includes six DX4/100-based notebooks: the dual-scan color Aspen Universa-E Series ($3,100), the active-matrix color Commax SmartBook III ($4,400, with 16MB of RAM and a 527MB hard disk), Duracom 5110 ($4,689, with port replicator and modem), FutureTech FutureMate FM910T ($3,989 with 16MB of RAM), Tri-Star MediaBook ($3,995), and the dual-scan passive-matrix color Broadax BSI NP9249D ($2,745). Two 486DX2/66 notebooks are also included: the dual-scan passive-matrix color Micro Express NB9266 ($2,399) and the active-matrix color Milkyway MyriadBook/466 ($3,850, including a $455 docking station). Some vendors offer models with different CPUs, screen types, and hard disks than are seen here.

Duracom 5110

	Windows applications	DOS applications	Road warrior	Desktop replacement
Aspen Universa	GOOD	GOOD	GOOD	GOOD
BSI NP9249D	GOOD	GOOD	GOOD	FAIR
Commax Smart-Book	GOOD	GOOD	FAIR	GOOD
Duracom 5110	GOOD	GOOD	GOOD	GOOD
FutureTech FM910T	GOOD	GOOD	GOOD	GOOD
Micro Express NB9266	GOOD	GOOD	GOOD	GOOD
Milkyway Myriad Book/466	FAIR	FAIR	GOOD	FAIR
Tri-Star MediaBook	GOOD	GOOD	GOOD	GOOD

These systems have 9.5-inch displays (except for the Micro Express unit, which has a 10.5-inch display), a recessed keyboard, and a large two-button trackball sunken into the center of the wrist rest. Most came with 8MB of RAM (16MB on the Commax and FutureTech units) and a removable 340MB hard disk (527MB on the Commax unit). System RAM can be expanded to 36MB. The notebooks use a VL-Bus video subsystem with 1MB of DRAM, except for the FutureTech and Micro Express systems, which use 1MB of VRAM.

These units are rather hefty, with a travel weight of just over 8 pounds for the Milkyway, Micro Express, and Broadax systems, and about 8 pounds 8 ounces for the others. The weight differences are explained by the dual-scan color screens in the Broadax and the Micro Express units and the lighter nickel cadmium battery pack in the Milkyway notebook.

One nice feature of this notebook case is an extra-large PCMCIA slot, which can accommodate a Type III and a Type II PCMCIA device at the same time. This means you can add a PCMCIA hard disk to these notebooks and still have room for another Type II PCMCIA device, such as a fax modem or network adapter.

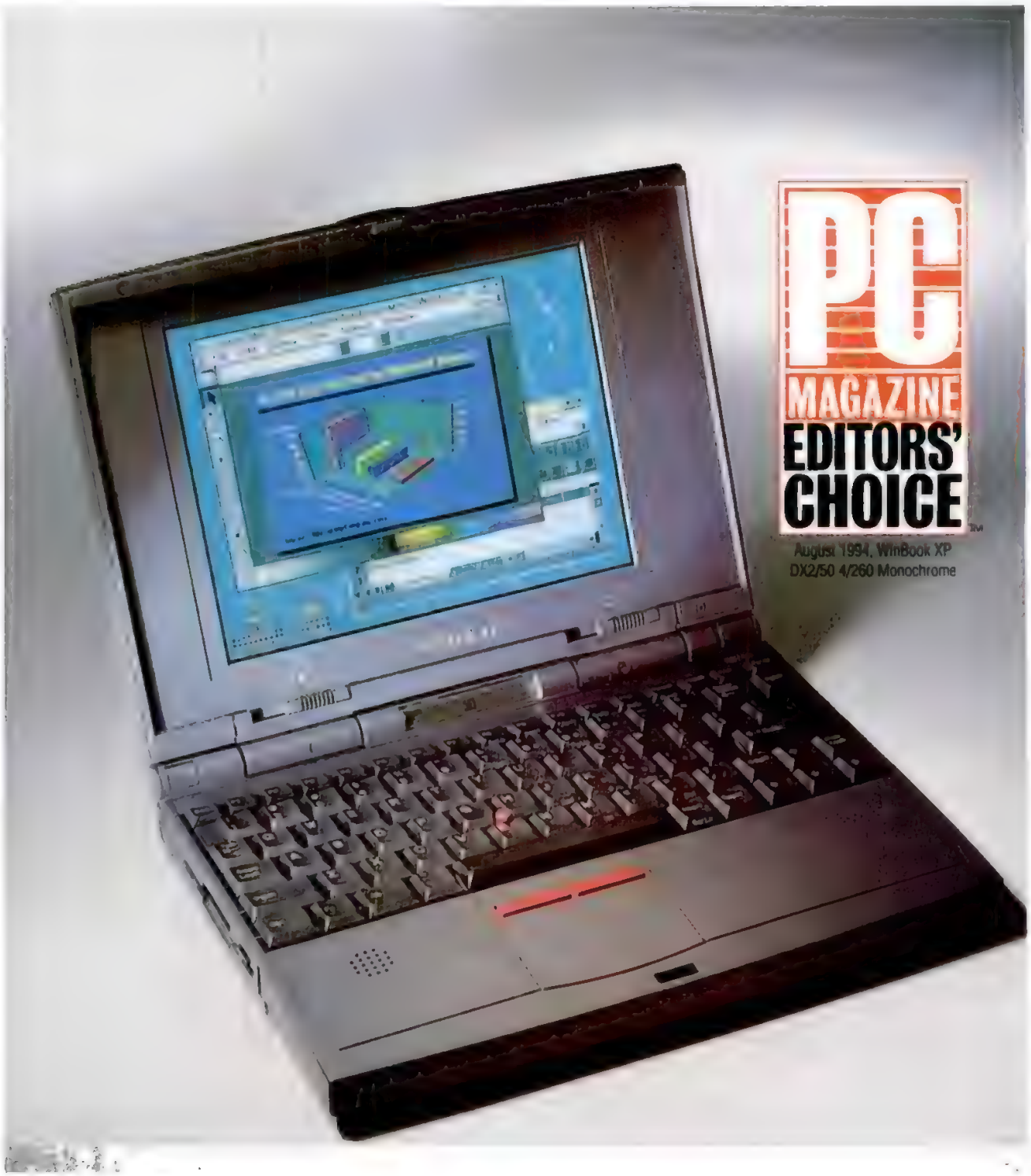
The notebooks in this group come with Sound Blaster– and Windows Sound System–compatible stereo-audio subsystems and have a built-in speaker and microphone. Jacks for external microphones and speakers and for direct audio input are located just below the nonremovable floppy disk drive on the right side. On the bottom left side, the units have removable hard disks that slide out easily once a latch is pushed.

All of the notebooks came with preinstalled Microsoft Windows audio-utility software. Unfortunately, the hum of the hard disk and the whir of a small fan built into the right side of each unit are audible when you use the built-in microphone.

A nice convenience common to these notebooks is twin, half-size battery packs which can be swapped out independently. The battery packs, which are easily removable but snap firmly in place, are monitored by separate front-panel LEDs. Unfortunately, the battery packs cannot be recharged while the system is in use.

Battery life was not a high point with these units. On our WinDrain battery test, the best time in this group was logged by the dual-scan color BSI NP9429D, which lasted 1 hour 40 minutes. Most of the systems in this group had battery lives of between 1 hour 13 minutes and 1 hour 30 minutes—times which placed these machines near the bottom when compared with all the notebooks in this review. Not surprisingly, the MyriadBook/466, the only one

Don't take our word for what a great value and performer the WinBook *XP* is. Read what the experts have to say:



WinBook XP

Highest quality, best features, lowest price!

PC MAGAZINE "With plenty of processing power, (and) enough battery life to handle a transcontinental flight easily,...the WinBook XP...is a value winner." "...the WinBook XP is the lightest full-size notebook in the roundup; it also had excellent battery life..., optional audio and a good price..."

PC MAGAZINE, Cover Story: Notebooks, Aug. 1994

PC WORLD "(The) WinBook is a fast, well-set-up DX4-75 notebook." "We found a lot to like in this capable, well-outfitted mobile unit. It earns a spot on our Power Mobile PCs shortlist."

PC WORLD, Systems: Top 20, Dec. 1994

DX4-100 Now Available

LAPTOP "...the WinBook XP is a great Windows PC, and an excellent value." "...the fact that you get the amount of performance we did from a battery charge speaks highly of the engineering that went into the WinBook XP."

LAPTOP BUYERS GUIDE & HANDBOOK, First Look, Dec. 1994

COMPUTER SHOPPER "In terms of value,...(the WinBook XP) ranks above many famous-name notebooks. And in terms of pointing devices, it's definitely got them out-numbered." "...if you're looking for a well-equipped, wallet pleasing portable, the WinBook XP deserves a spot on your short list." "...the WinBook with modem is $700 less than a comparably equipped, modemless (Dell Latitude XP) 475C."

COMPUTER SHOPPER, PC Reviews, Nov. 1994

WINDOWS MAGAZINE "The first WinBook I reviewed was a Power Book look-alike that offered good performance and great battery life. The newest member of the line—the WinBook XP—has the longest battery life that I've ever seen." "The WinBook XP represents the best kind of innovation in the rapidly changing field of notebook computers. It keeps the best of proven technologies, such as a sharp display, and complements them with new technologies, such as those employed to stretch battery life. The long battery life makes it a good choice for anyone who needs a basic notebook that also delivers solid performance." *WINDOWS MAGAZINE*, WinLab First Impressions, Dec. 1994

SPECIFICATIONS

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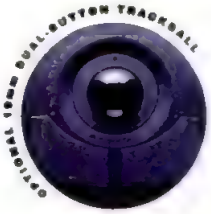

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Benchmark Tests: Color Portables

Notebooks are aiming to close the performance gap with desktops as Pentium CPUs, L2 processor cache, and PCI-based Enhanced IDE disk subsystems migrate into under-10-pound packages. But the results of our benchmark tests illustrate the importance of tuning; you can't always find the best performers just by glancing at spec sheets.

What the Numbers Mean

The speediest of the 68 machines we tested was ten times as fast as the slowest. Still, the best-performing notebooks we tested were only about two-thirds the speed of the fastest desktops we've seen—and that's comparing Pentium/90 against Pentium/90. Roughly the same ratio holds for graphics performance: Both the best notebook and the average notebook here were roughly half as fast as their desktop PC counterparts.

Notebooks' performance can be influenced in ways you might not expect. As an example, take L2 cache. Though a machine with L2 cache will generally outperform one without cache at a given processor level, that often wasn't the case for these notebooks. The culprit: core-logic chip sets that access system memory inefficiently. Of the 63 486-class notebooks in this roundup, 9 were equipped with L2 cache; a detailed look at subsystem test results showed that the SIS and ACC Micro Electronics chip sets in 486-level machines with 128K of L2 cache actually degraded performance of the processor/memory subsystem.

How do we know? Our PC Bench 9.0 processor tests include a number of instruction mixes that exercise different aspects of processor, L1 cache, L2 cache, and memory subsystems. We run a small (1K) instruction mix that exercises only the processor and L1 cache; our standard (48K) mix that also covers L2 cache; and our large (400K) instruction mix that exercises the complete CPU, cache, and memory subsystems. (The CPUmark$_{16}$ results presented here are a composite of our large instruction mix and a minimally weighted floating-point component.) On the small instruction mix, machines with SIS or ACC chip sets performed at the same level as those using other chip sets from OPTi or Pico Power. On the standard mix, performance of the SIS- and ACC-equipped machines was strong, thanks to the presence of L2 cache. But when we added main-memory accesses, the notebooks with SIS or ACC chip sets performed at as little as half the level of other systems—in spite of their L2 cache.

We found more surprises when we looked at disk subsystems. Two of these notebooks paired Enhanced IDE hard disks with a PCI bus—a combination that, at least in well-tuned desktops, outperforms standard IDE implementations. But the disk subsystems in these two machines (the ARMNote TS30PS and MidWest Micro Elite Pentium SoundBook Plus) could not support the 32-bit file cache capability of Microsoft Windows for Workgroups. The ARMNote TS30PS posted a low Disk WinMark 95 score of 114 (the average was 253); the MidWest Micro unit was unable to complete the Disk WinMark tests successfully.

WINSTONE 95

Another surprise came on our Winstone tests: The five Pentium units we tested were solid performers, but they weren't unassailable. The top Winstone score of 103 did go to the 90-MHz MidWest Micro SoundBook Plus, but the second-, third-, and fourth-place scorers were DX4/100 systems. We also found that machines with 16MB of RAM didn't always outperform similar systems with only 8MB of RAM.

Winstone performance of the slowest unit, the Compaq Contura Aero 4/33c Model 170, reached only 7—less than our 386DX/25 reference desktop system with 4MB of RAM, which by definition has a score of 10. That's partly because the Compaq Aero uses the Intel 486SXJ CPU, which has only a 16-bit data bus.

GRAPHICS WINMARK 95 AND DISK WINMARK 95

On our Graphics WinMark 95 tests, systems with the Western Digital WD90C24 Rocket accelerator chip were strong performers overall. Almost half of the notebooks—31 of the 68—utilized the Rocket chip. We were also impressed by the performance of the Chip & Technologies CL-GD65545 used in the top-scoring Panasonic V41 CD-ROM notebook. But the Panasonic system was the only one able to complete the Graphics WinMark tests successfully with C&T's drivers of October 10, 1994 (the most recent revision available at test time). For the other C&T-based machines, we either used earlier versions of the drivers that were provided on the test systems or contacted vendors to request earlier driver versions. In these cases, performance was not as strong.

On our Disk WinMark tests, we found that machines running Windows for Workgroups 3.11 outperformed comparable machines running Windows 3.1 by a margin of 60 percent.

CPUMARK$_{16}$

The CPUmark$_{16}$ tests, which measure performance of the processor and memory subsystem, showed a distinct advantage for the two Pentium/90 units in this roundup—the ARMNote TS30PS and the MidWest Micro SoundBook Plus. The top-scoring 486 units lacked L2 cache, avoiding of the memory-timing problems associated with tested chip sets that support L2 cache.

The most impressive of the 486-class systems was the TI TravelMate 4000M DX4/75 Dual Scan, which actually scored higher than any DX4/100-based system. The lowest-scoring system was the ZDS Z-Lite; it is based on a Cyrix Cx486DLC/33 CPU, which has only 1K of on-board cache and doesn't support burst-mode transfers.

DOSMARK

DOS performance on nearly any 486-class desktop may be sufficient for even

the most demanding DOS applications, but DOS performance on notebooks is not quite there yet. L2 cache is often missing or poorly implemented in notebooks. Portable systems also incorporate less-sophisticated graphics engines.

The top-scoring FutureTech FutureMate FM366T (based on a Pentium/66 CPU) was about 25 percent below the average Pentium/66 desktop.

BATTERY LIFE

We generated battery life scores using PC Magazine Labs' WinDrain tests, which employ a heavy-usage scenario with systems kept active and no power management enabled. This diverges from the ZDigit testing that we have conducted in the past, because it performs constant disk and screen activity until the battery is fully exhausted. The CPU is run at full speed throughout these tests.

Battery Life with Power Management

Hours:minutes	WinDrain	ZDigit
AST Ascentia 900N	2:45	3:33
Dell Latitude XP 450C	3:31	3:58
Ergo PowerBrick 100	1:45	3:13
Everex Step Note DX2/50	2:01	3:40
IBM ThinkPad 755CD	2:35	3:49
Panasonic V41	0:50	1:10
TI 4000M/50	2:40	3:56
Toshiba Portégé T3600CT	3:58	6:53

Many notebooks had WinDrain scores of well over 2 hours; the Toshiba Portégé T3600CT and the Dell Latitude XP 450C, which both use lithium ion batteries, ran for over 3.5 hours. The nickel hydride–based TI TravelMate 4000M/50 Dual Scan lasted 3 hours 8 minutes.

PC Magazine Labs, along with Ziff-Davis Labs and the Ziff-Davis Benchmark Operation, are currently conducting a complex research and development effort to update ZDigit test methodology. For this issue, we ran our existing ZDigit tests on selected notebooks with power management features enabled to represent a moderate-usage scenario. On these systems, we set a disk timeout of 1 minute, a screen timeout of 2 minutes, and a standby timeout of 3 minutes (or as close to these settings as the systems permitted). Systems were not permitted to enter full suspend or hibernation mode. We set screens at a subjectively comfortable viewing level rather than at full brightness.

The chart shown at the left illustrates that ZDigit results are substantially higher than WinDrain results, thanks to the effects of power management and a less intensive usage pattern. Surprisingly, though, the lithium ion–equipped Dell and Toshiba systems did not realize significant improvements under ZDigit. This may indicate that some low-level power management functions that cannot be disabled were in use during our WinDrain test.

How We Tested

For all tests, we enabled the latest version of SMARTDRV.EXE provided on the tested system; we also used a cache size of 2MB (on 8MB systems) or 4MB (on 16MB or larger systems), with write-behind caching enabled. For systems running Microsoft Windows for Workgroups, we set up a file cache of 2MB (on 8MB systems) or 4MB (on 16MB or larger systems). We directed Windows to use a 20MB permanent swap file but did not change the vendor's setting for 32-bit disk access.

We used the custom graphics drivers for provided graphics chip sets and set resolution to 640-by-480 with 16 colors and small fonts. Some notebooks came with drivers for only 640-by-480 with 256 colors; they were tested at that color depth. We disabled power-management features for all performance tests.

We used our **Winstone 95,** Version 1.0, benchmark test suite to measure the machines' performance when running typical Windows applications. Winstone measures the time a PC takes to execute a set of application scripts that exercise 13 of the best-selling Windows 3.*x* applications. It then weights the individual script execution times using the unit market shares of the applications and normalizes scores against a reference machine—a 386DX/25 Compaq Deskpro/M with 4MB of RAM—whose score is defined to be 10. Winstone also produces system performance scores in four categories: Spreadsheet, Word Processing, Database, and Business Graphics/Desktop Publishing.

Another test suite, WinBench 95, uses 102 different tests of Windows GDI (Graphics Device Interface) functions to produce the **Graphics WinMark 95** score—a measure of a PC's graphics performance under Windows 3.*x*. These graphics tests, which are based on extensive application profiling, run in 13 graphics test mixes that WinBench weights and combines. Graphics WinMark scores are reported in millions of pixels per second.

WinBench 95 also produces a **Disk WinMark 95** score, which reflects the performance of a PC's disk subsystem under Windows 3.*x*. The test suite uses a variety of files and directories in a blend based on profiling of applications' disk usage in Winstone.

PC Bench 9.0 predicts processor, video, and disk performance under DOS applications. A composite PC Bench score, the **DOSMark,** is a summary of those three results that approximates overall system performance under DOS.

PC Bench's **CPUmark$_{16}$** score indicates the speed of a PC's processor subsystem, which includes the CPU, secondary cache, and system RAM. PC Bench bases this score on a large (400K) instruction mix and either the floating-point coprocessor test or the floating-point emulation test, depending on whether the tested PC contains a math coprocessor.

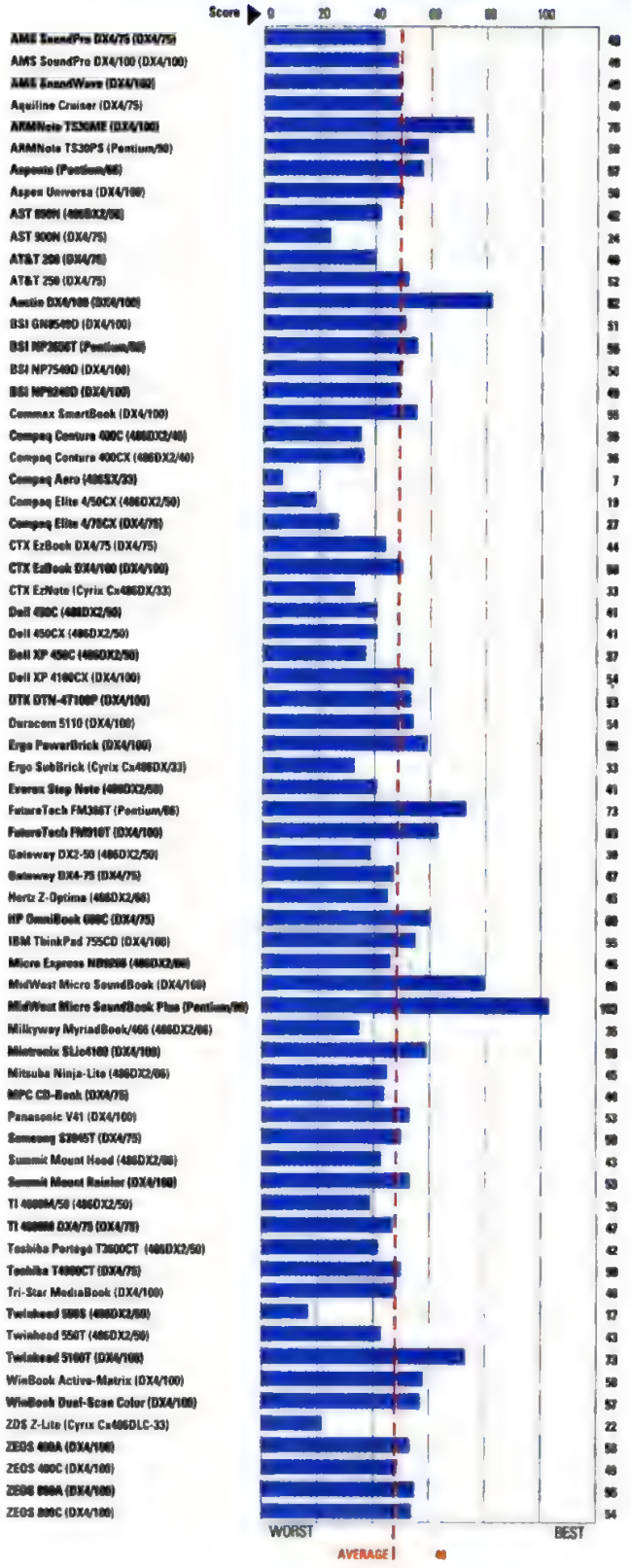
The PC Bench **DOS Video** score indicates the speed of 8- and 16-bit VGA read and write operations involving both text and graphics.

The PC Bench **DOS Disk** score indicates the DOS performance of a PC's disk subsystem, which includes the hard disk, disk controller, and any hardware or software disk caches. The Disk Mix test that produces this score works with hundreds of files in over 100 directories totaling over 28MB in size. The test performs file reads, writes, creations, and deletions in a mix based on the disk usage of a set of profiled applications.

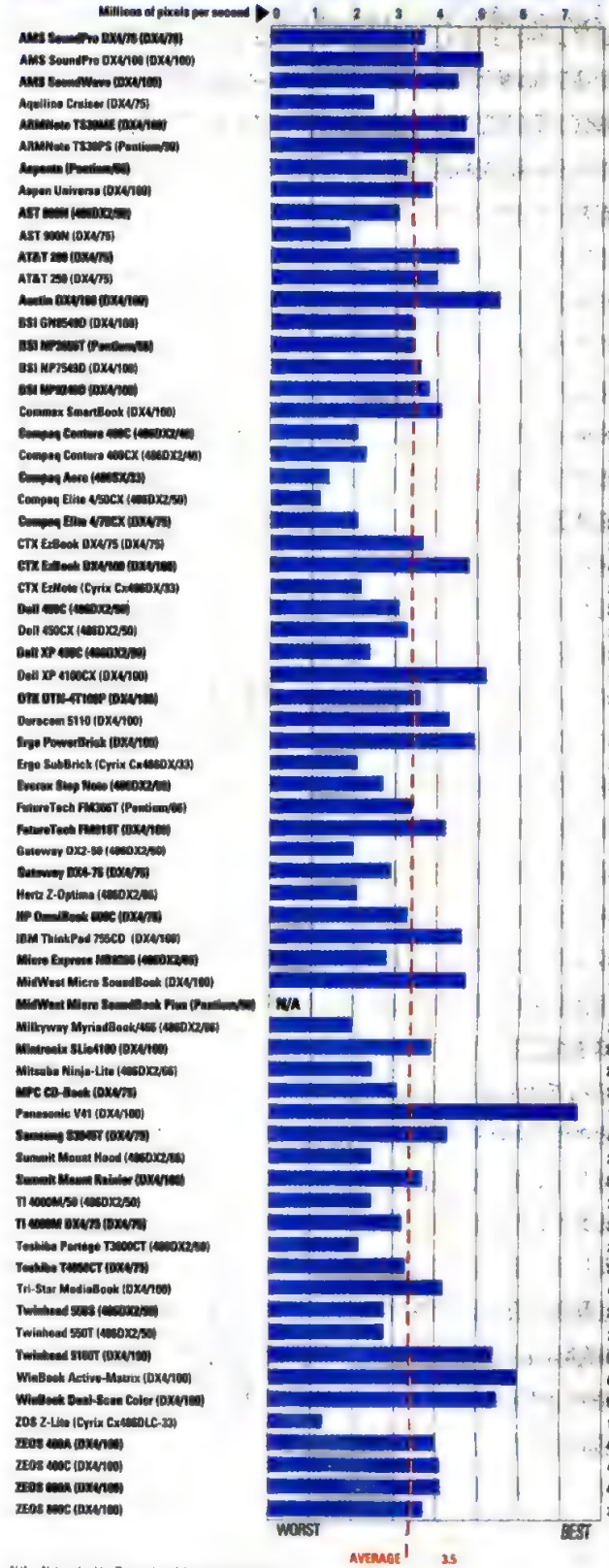
The **Battery Life** score reflects life of the PC's battery under intensive use with power management (including Microsoft Advanced Power Management, where applicable) disabled and screens at full brightness. We determine this score by running our WinDrain program until the battery is depleted; we expect it to represent the minimum battery life of the notebook. The WinDrain program constantly writes to a file and updates the screen to keep it active. During the test we prevent each notebook from entering a power-saving mode by feeding it keystrokes, either through an external keyboard port or using a hardware device that taps a key. Some intelligent chip sets may drop the notebook into power-saving mode between keystrokes, but since this occurs for only a short interval and since we keep the display and disk active, we don't believe it confers a significant advantage in this test.—*Analysis written by Richard Fisco*

Benchmark Tests: Color Portables

WINSTONE 95



GRAPHICS WINMARK 95



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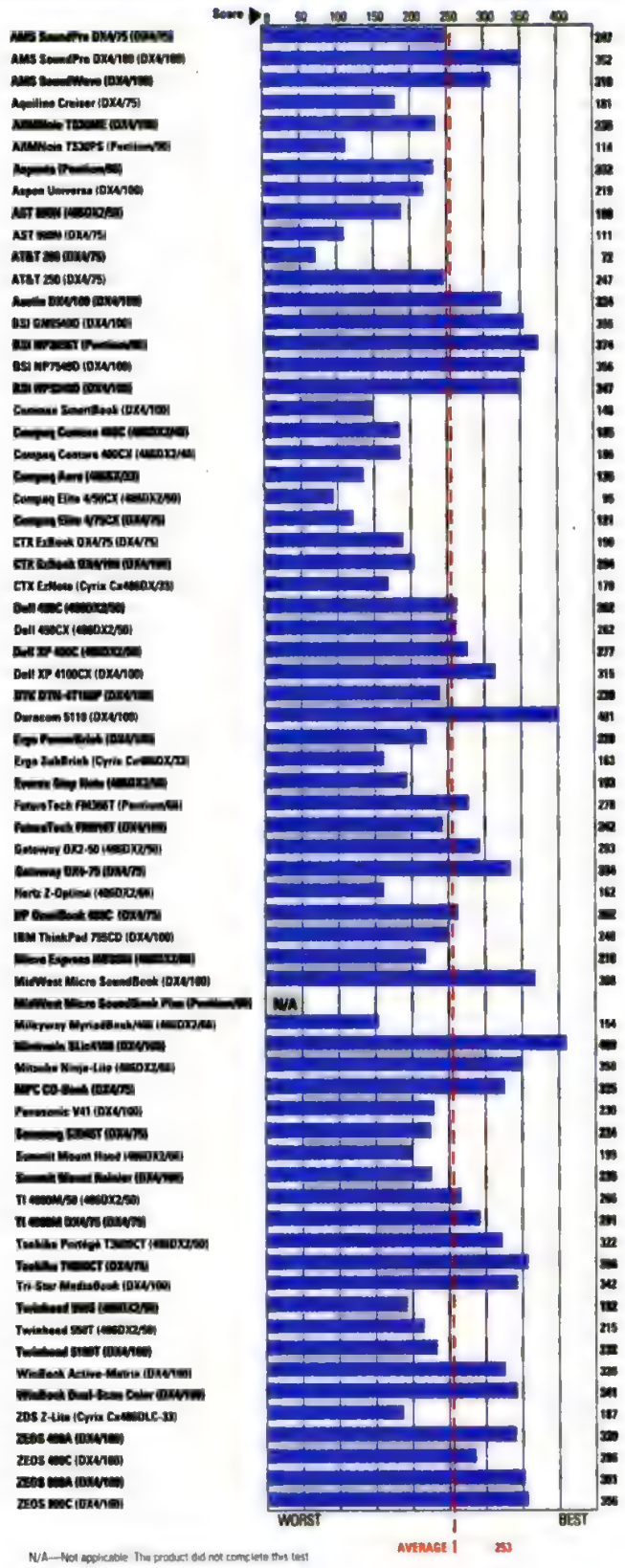
DISK WINMARK 95



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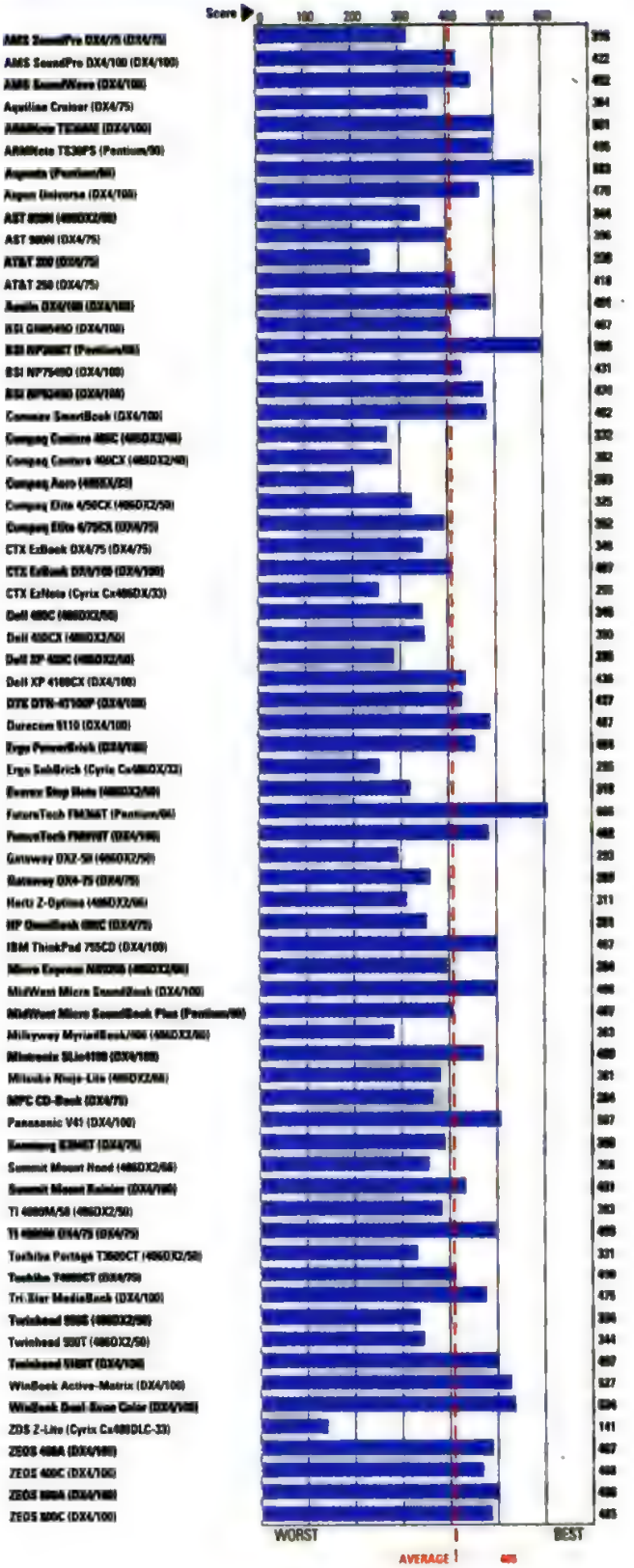

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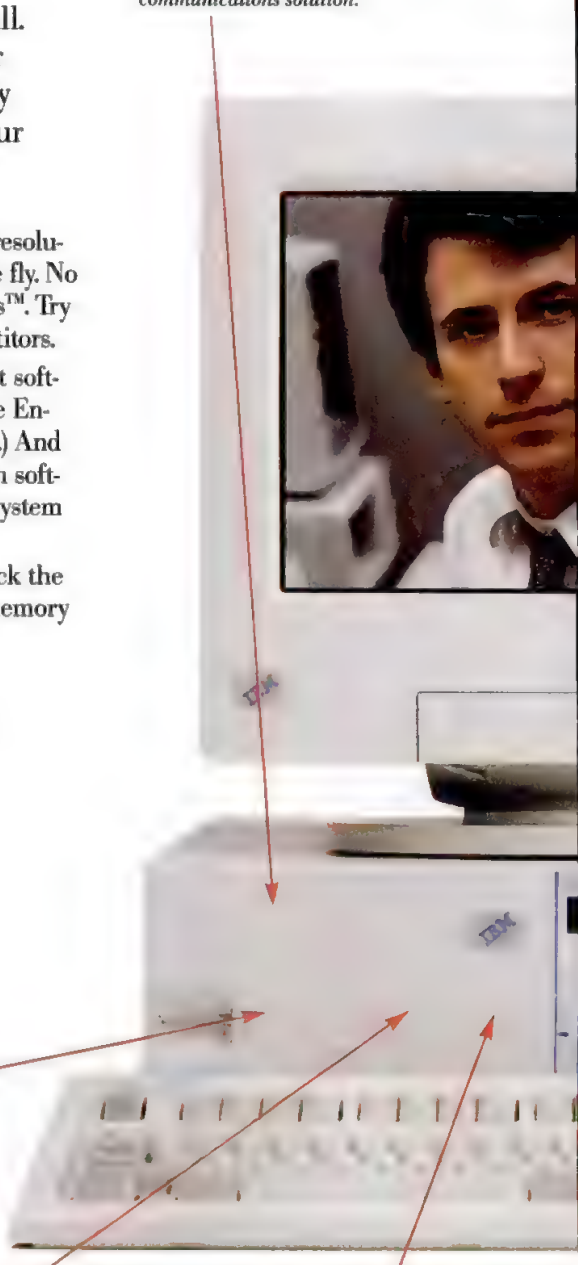

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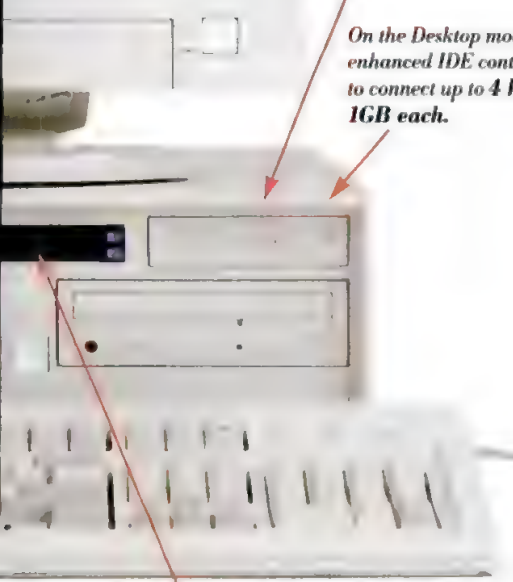

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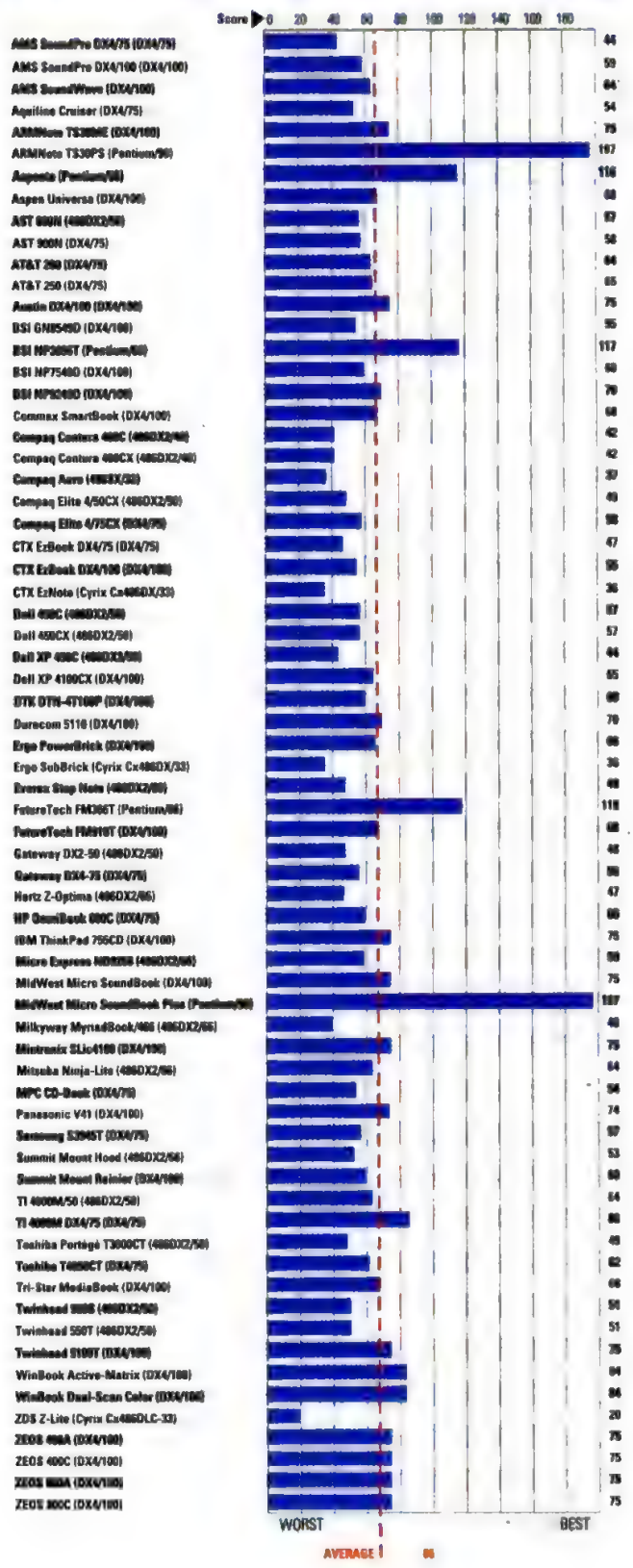
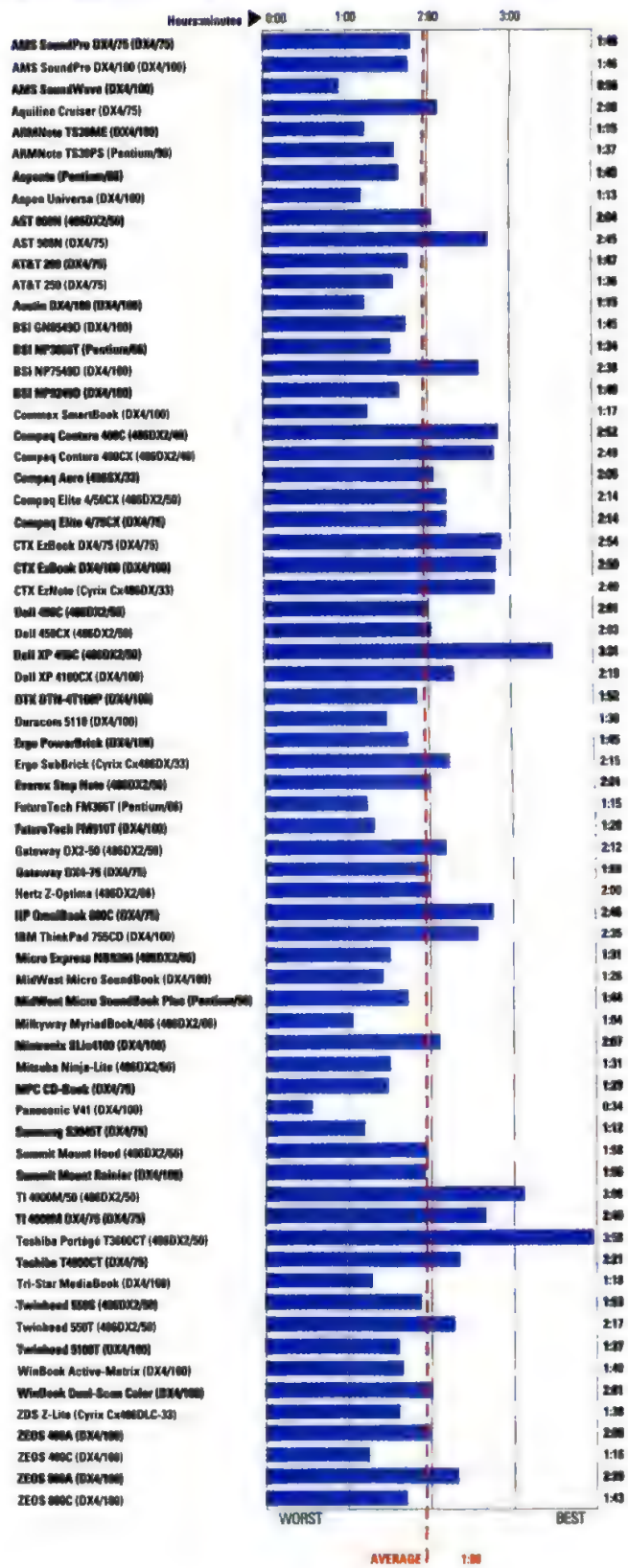
Benchmark Tests: Color Portables

CPUMARK16



WINDRAIN



Higher scores represent better performance.

	DOS Video (score)	DOS Disk (score)	Winstone 95 Spreadsheet Category (score)	Winstone 95 Word Processing Category (score)	Winstone 95 Database Category (score)	Winstone 95 Business Graphics/DTP Category (score)
AMS SoundPro DX4/75 (DX4/75)	2,466	366	4.4	4.6	3.5	4.3
AMS SoundPro DX4/100 (DX4/100)	3,264	403	4.8	5.0	4.0	5.6
AMS SoundWave (DX4/100)	4,182	397	5.0	5.2	3.9	5.7
Aquiline Cruiser (DX4/75)	2,907	311	4.9	4.7	4.7	5.7
ARMNote TS30ME (DX4/100)	2,926	453	7.5	7.3	6.7	9.0
ARMNote TS30PS (Pentium/90)	2,323	230	6.5	5.1	5.2	8.0
Aspenta (Pentium/66)	2,697	400	5.6	6.0	4.6	6.8
Aspen Universa (DX4/100)	3,415	422	5.0	5.3	4.1	5.8
AST 800N (486DX2/50)	2,073	264	4.3	4.6	3.5	4.6
AST 900N (DX4/75)	2,545	366	2.5	2.5	2.0	2.8
AT&T 200 (DX4/75)	2,539	115	4.0	3.8	3.9	4.8
AT&T 250 (DX4/75)	2,272	366	5.3	5.4	4.3	6.2
Austin DX4/100 (DX4/100)	4,428	392	8.2	7.7	7.4	10.1
BSI GN8549D (DX4/100)	3,630	392	5.1	5.4	4.1	6.0
BSI NP3656T (Pentium/66)	2,694	416	5.4	5.7	4.4	6.7
BSI NP7549D (DX4/100)	3,082	420	5.1	5.2	4.1	6.0
BSI NP9249D (DX4/100)	2,486	456	4.9	5.1	4.1	5.7
Commax SmartBook (DX4/100)	3,645	448	5.7	5.1	5.2	6.0
Compaq Contura 400C (486DX2/40)	1,862	229	3.5	3.5	2.9	4.0
Compaq Contura 400CX (486DX2/40)	2,096	245	3.6	3.7	3.0	4.0
Compaq Aero (486SX/33)	650	182	0.8	0.8	0.5	0.8
Compaq Elite 4/50CX (486DX2/50)	3,636	253	2.0	2.0	1.6	2.2
Compaq Elite 4/75CX (DX4/75)	2,496	355	2.7	2.8	2.2	3.0
CTX EzBook DX4/75 (DX4/75)	3,183	340	4.4	4.5	3.6	4.9
CTX EzBook DX4/100 (DX4/100)	4,099	381	5.0	5.3	4.0	5.5
CTX EzNote (Cyrix Cx486DX/33)	3,655	213	3.3	3.4	2.7	3.6
Dell 450C (486DX2/50)	2,072	268	4.1	4.2	3.3	4.8
Dell 450CX (486DX2/50)	2,372	268	4.2	4.3	3.3	4.8
Dell XP 450C (486DX2/50)	1,906	239	3.8	3.9	3.0	4.4
Dell XP 4100CX (DX4/100)	2,796	388	5.5	5.7	4.3	6.3
DTK DTN-4T100P (DX4/100)	3,082	406	5.3	5.6	4.3	6.2
Duracom 5110 (DX4/100)	3,886	433	5.4	5.5	4.5	6.3
Ergo PowerBrick (DX4/100)	4,220	381	6.2	5.5	5.7	6.6
Ergo SubBrick (Cyrix Cx486DX/33)	3,667	214	3.3	3.5	2.7	3.7
Everex Step Note (486DX2/50)	3,307	251	4.1	4.2	3.3	4.8
FutureTech FM366T (Pentium/66)	2,698	431	7.1	6.9	6.7	8.8
FutureTech FM910T (DX4/100)	3,647	448	6.3	6.1	5.7	7.5
Gateway DX2-50 (486DX2/50)	2,092	221	3.8	4.0	3.2	4.6
Gateway DX4-75 (DX4/75)	2,091	306	4.7	4.9	3.8	5.5
Hertz Z-Optima (486DX2/66)	1,990	269	4.4	4.5	4.0	5.4
HP OmniBook 600C (DX4/75)	2,357	254	5.9	5.8	5.7	6.8
IBM ThinkPad 755CD (DX4/100)	2,911	444	5.5	5.7	4.5	6.3
Micro Express NB9266 (486DX2/66)	2,479	346	4.5	4.7	3.8	5.3
MidWest Micro SoundBook (DX4/100)	2,923	446	7.9	7.6	7.3	9.5
MidWest Micro SoundBook Plus (Pentium/90)	2,741	169	9.4	9.6	10.1	13.3
Milkyway MyriadBook/466 (486DX2/66)	3,261	237	3.6	3.7	2.9	4.2
Mintronix SLic4100 (DX4/100)	2,062	430	5.9	6.1	4.9	7.1
Mitsuba Ninja-Lite (486DX2/66)	1,619	328	4.5	4.6	3.7	5.5
MPC CD-Book (DX4/75)	1,843	351	4.4	4.6	3.6	5.3
Panasonic V41 (DX4/100)	3,852	445	5.4	5.8	4.2	6.0
Samsung S3945T (DX4/75)	2,525	350	5.1	5.3	4.0	5.6
Summit Mount Hood (486DX2/66)	3,057	292	4.3	4.5	3.5	5.1
Summit Mount Rainier (DX4/100)	3,527	404	5.3	5.6	4.2	6.1
TI 4000M/50 (486DX2/50)	2,426	291	4.0	3.9	3.4	4.7
TI 4000M DX4/75 (DX4/75)	2,440	382	4.6	4.8	3.9	5.4
Toshiba Portégé T3600CT (486DX2/50)	2,733	277	4.2	4.3	3.5	5.1
Toshiba T4850CT (DX4/75)	2,694	350	5.0	5.2	4.2	5.8
Tri-Star MediaBook (DX4/100)	3,860	424	4.8	5.0	3.9	5.5
Twinhead 550S (486DX2/50)	3,449	256	1.7	1.7	1.7	1.8
Twinhead 550T (486DX2/50)	3,705	274	4.3	4.5	3.5	5.0
Twinhead 5100T (DX4/100)	4,414	403	7.2	7.1	6.7	8.4
WinBook Active-Matrix (DX4/100)	4,583	392	5.7	6.1	4.6	7.0
WinBook Dual-Scan Color (DX4/100)	4,105	415	5.7	6.1	4.5	6.8
ZDS Z-Lite (Cyrix Cx486DLC-33)	1,636	123	2.3	2.4	1.8	2.3
ZEOS 400A (DX4/100)	3,461	401	5.3	5.6	4.3	6.2
ZEOS 400C (DX4/100)	3,481	361	5.1	4.9	4.1	5.9
ZEOS 800A (DX4/100)	3,449	423	5.5	5.7	4.4	6.4
ZEOS 800C (DX4/100)	2,795	423	5.4	5.6	4.4	6.4
AVERAGE	**2,933**	**338**	**4.8**	**4.9**	**4.1**	**5.7**

in this group to use nickel cadmium batteries instead of the nickel hydride type, logged the shortest time with a battery life of 1 hour 4 minutes.

While all the vendors offer PCMCIA accessories, the Duracom 5110 was the only notebook in this group which came to us with a 2,400-/9,600-bps PCMCIA data/fax modem and QuickLink II data and fax communications software. The Duracom 5110 also came with a $90 port replicator, which offers two serial ports, single parallel, keyboard, VGA and SCSI ports, and a speaker jack. Other vendors in this group sell the port replicator as well. They also sell a multimedia-ready docking station, which comes with stereo speakers, a drive bay for a CD-ROM drive or 5.25-inch hard disk, and four expansion slots (two ISA, two VL-Bus). Duracom offers this docking station for $490 and the same docking station is available from other vendors (priced from $450 to $550).

On our benchmark tests, we found very little spread in most of the test scores for the six DX4/100-based units. On the Winstone 95 tests, the FutureTech FM910T logged an above-average score; the Commax and Duracom units posted average scores, and the other DX4/100 systems had below-average scores. The DX4/100 units posted average Graphics WinMark 95 scores (except for the Aspen and BSI units, whose scores were below average).

On the Disk WinMark 95 tests, the Duracom, Broadax, and Tri-Star units logged above-average scores, but the other DX4/100 systems were below-average performers. On the DOS Video tests, all of the DX4/100 units yielded above- or just-below-average scores, except for the dual-scan color BSI NP9249D, which was well below the average.

The 486DX2/66-based NB9266 logged above-average scores for its CPU class on every test except the DOS Video, Disk WinMark, Winstone, and CPUmark$_{16}$ tests, where it was average. The MyriadBook yielded the worst scores among all reviewed 486DX2/66 notebooks on all tests—except the DOS Video tests, where it had the best score for its CPU group.
—Robert S. Anthony

▶ **Aspen Universa-E Series.** Aspen Computer Inc., *Buffalo, NY; 800-472-3273,*

716-626-0315; fax, 716-626-1541.
Circle 447 on reader service card

▶ **BSI NP9249D.** Broadax Systems Inc., *El Monte, CA; 800-872-4547, 442-0020; fax, 818-442-4527.*
Circle 451 on reader service card

▶ **Commax SmartBook III.** Commax Technologies Inc., *San Jose, CA; 800-526-6629, 408-435-5000; fax 408-435-5020*
Circle 452 on reader service card

▶ **Duracom 5110.** Duracom Computer Systems, *Irving, TX; 800-551-9000, 214-518-1200; fax, 214-518-1090.*
Circle 457 on reader service card

▶ **FutureTech FutureMate FM910T.** FutureTech Systems Inc., *Hackensack, NJ; 800-275-4414, 201-488-4414; fax 201-488-4405.*
Circle 460 on reader service card

▶ **Micro Express NB9266.** Micro Express, *Santa Ana, CA; 800-989-9900, 714-852-1400; fax, 714-852-1225.*
Circle 465 on reader service card

▶ **Milkyway MyriadBook/466.** Milkyway Computer Products, *Fremont, CA; 800-536-6582, 510-659-8812; fax, 510-659-8526.*
Circle 467 on reader service card

▶ **Tri-Star MediaBook.** Tri-Star Computer, *Tempe, AZ; 800-800-7668, 602-731-4926; fax, 602-931-4979.*
Circle 476 on reader service card

AST Research Inc.
EDITORS' CHOICE ▶ **• AST Ascentia 800N**
Dell Computer Corp.
EDITORS' CHOICE ▶ **• Dell Latitude 450C**
• Dell Latitude 450CX

The $2,806 AST Ascentia 800N from AST Research and the $3,428 Dell Latitude 450CX and the $2,728 Dell Latitude 450C from Dell Computer provide above-average performance in the 486DX2/50 processor class as well as a 2-hour battery life under heavy usage. An even longer battery life is possible since the units' removable floppy disk drive can accommodate a second battery. Although they lack sound capability, each of these nearly identical systems is very competitively priced and as well designed as any in this review.

All three notebooks are manufactured by Quanta Computers of Taiwan. The 450CX has an active-matrix display and a travel weight of 6 pounds 15 ounces; the 450C and the 800N have dual-scan passive-matrix displays and travel weights of 6 pounds 11 ounces and 6 pounds 8 ounces, respectively. All three displays measure 9.5 inches diagonally, and all three use a Western Digital 90C24A2 graphics accelerator chip set that can manage an external noninterlaced display of 1,024 by 768 pixels. The three units also use the same 340MB Seagate hard disk. Though all of these systems have an integrated trackball, the type found on the 450CX and 450C units is slightly more sculpted than that of the 800N, and as a result, its buttons are more comfortable to use.

AST Ascentia 800N

	Windows applications	DOS applications	Road warrior	Desktop replacement
AST 800N	FAIR	FAIR	GOOD	FAIR
Dell 450C	FAIR	FAIR	GOOD	FAIR
Dell 450CX	FAIR	GOOD	GOOD	FAIR

AST targets the value customer with the 800 line, and aims at the corporate user with its Ascentia 900 systems, which offer processors up to DX4/75s and larger hard disks. Dell's Latitude line is also a value line. For more high-powered users, Dell has a Latitude XP line, which uses a higher level processor (up to a DX4/100) as well as longer-lasting lithium ion batteries. (Representatives of AST's Ascentia 900 line and Dell's Latitude XP line are reviewed separately.)

In terms of battery life, all three machines matched each other almost down to the minute; all use nickel hydride batteries. The 450CX lasted 2 hours 3 minutes, just 2 minutes longer than the dual-scan 450C and 1 minute less than the 800. Of course, the optional second battery will increase these times considerably; Dell offers a second battery for $99 and AST offers one for $102.

On our benchmark tests, each system performed competitively within the 486DX2/50 processor group. The 450CX posted the best Graphics Winmark 95 score in this processor range; the 800 and 450C were close behind. The 450CX's Winstone 95 and Disk WinMark 95 scores were above average. The scores of both the 450C and the 800 mirrored the 450CX's, except on the Disk WinMark tests, where the 800's scores were the lowest of the group.

Options on the Latitude systems include a hard disk upgrade of up to 524MB. For those who need sound capability, Dell offers a PCMCIA sound card for $249. AST offers an Ethernet adapter for $249 and both companies have 14.4-Kbps fax modems for $249. System memory expands to 20MB; Dell prices the 4MB upgrade at $229 and the 16MB upgrade at $1,399. AST's upgrades are priced at $207 for 4MB, $552 for the 8MB upgrade, and $1,152 for the 16MB upgrades.

A difference exists between the two companies when it comes to service and support. Dell offers the standard one-year parts-and-labor warranty with on-site service available for $149. AST increases that to a three-year warranty that includes parts and labor as well, but offers no on-site service.—*WPF*

▶ **AST Ascentia 800N.** AST Research Inc., *Irvine, CA; 800-876-4278, 714-727-4141; fax, 714-727-9355.*
Circle 448 on reader service card

▶ **Dell Latitude 450C, Dell Latitude 450CX.** Dell Computer Corp., *Austin, TX; 800-613-3355, 512-338-4400; fax, 800-727-8320.*
Circle 455 on reader service card

AST Research Inc.
• AST Ascentia 900N

Though $5,098 AST Ascentia 900N's performance is generally below the average of other DX4/75-based notebooks tested, it has some outstanding features not found in others here, such as a 10.4-inch active-matrix color display—among the largest in this review. AST also preloaded some useful software: LapLink and Lotus Organizer, and software that lets you access online services such as America OnLine,

CompuServe, and Prodigy.

With the 900N system, AST targets the corporate power user; the company's Ascentia 800N line (also reviewed in this story) is aimed at the value market. The 900N has a reasonable weight of 7 pounds 13 ounces, including AC adapter. In addition to its large display, the 900N has a removable enhanced IDE 510MB hard disk, an integrated SmartPoint trackstick, and two PCMCIA slots which can accommodate one Type III or two Type II cards. The 900N also supports an optional docking station. Graphics are handled by a Western Digital chip set with 1MB of VRAM. System memory is user-upgradable, simply by sliding off a small cover above the keyboard, to a maximum of 32MB.

AST Ascentia 900N

	Windows applications	DOS applications	Road warrior	Desktop replacement
AST 900N	FAIR	GOOD	EXCELLENT	GOOD

The 900N uses a nickel hydride battery; at 2 hours 45 minutes, battery life was strong for this CPU level. But on our Windows-based tests, the 900N was a poor performer compared with other DX4/75 systems. Though the CPUmark$_{16}$ score was average, the unit's scores on the Graphics WinMark 95, the Disk WinMark 95, and the Winstone 95 tests were well below the average of this group.—*WPF*

▶ **AST Ascentia 900N.** AST Research Inc., *Irvine, CA; 800-876-4278, 714-727-4141; fax, 714-727-9355.*

Circle 448 on reader service card

AT&T Global Information Solutions
• **AT&T Globalyst 200**
Samsung Electronics America
• **Samsung S3945T DX4/75**

The DX4/75-based $3,985 AT&T Globalyst 200 from AT&T Global Information Solutions, and $4,095 Samsung S3945T DX4/75 from Samsung Electronics America offer some attractive high-end features like active-matrix displays (each vendor makes its own internal display), upgradable processors, and support for simultaneous use of both Type II and Type III PCMCIA peripherals. Both systems falter, however, in the performance arena: Neither unit was able to break the 2-hour mark on our battery test nor stand out from the rest of the pack on our benchmark tests. In fact, of the two, the Samsung unit fared better even though it had only average scores on most of our benchmark tests.

The 200, using a 349MB Areal hard disk (upgradable to 810MB), had mixed results on our disk-subsystem tests: It earned an average score under DOS and a below-average score under Windows. The unit's Western Digital WD90C24A2 graphics chip set helped earn it an above-average score on the Graphics WinMark 95 tests and an average score on the Winstone 95 tests. The S3945T outpaced the 200 on nearly all of the benchmark tests but most dramatically on the Disk WinMark 95 and Winstone tests, where its results were average and above average, respectively. It used a 213MB Toshiba MK18824FCV hard disk (upgradable to 500MB) and the same graphics chip set as the 200. It still earned only average scores on most of the other tests, however.

Both units feature integrated trackballs located just beneath the ergonomically designed keyboard (the keyboard tilts at a 3-degree angle for easier use) and have traveling weights under 7 pounds 6 ounces. This AT&T unit, like the AT&T Globalyst 250 (reviewed separately), has a built-in floppy disk drive and one Type II and one Type III PCMCIA slot. Unlike the 250, however, the 200's floppy disk drive can't be replaced with an extra battery pack. The S3945T also has a built-in floppy disk drive and one Type II and one Type III slot that can be used simultaneously. The 200 and the S3945T offer screens that measure 10.3 and 9.5 inches diagonally, respectively. —*Angela Hickman*

AT&T Globalyst 200

	Windows applications	DOS applications	Road warrior	Desktop replacement
AT&T 200	FAIR	FAIR	GOOD	GOOD
Samsung S3945T	GOOD	GOOD	GOOD	GOOD

▶ **AT&T Globalyst 200.** AT&T Global Information Solutions, *Dayton, OH; 800-225-5627, 513-445-2000.*

Circle 449 on reader service card

▶ **Samsung S3945T DX4/75.** Samsung Electronics America, *Ridgefield Park, NJ; 800-933-4110, 201-229-4000; fax, 201-229-4069.*

Circle 472 on reader service card

AT&T Global Information Solutions
• **AT&T Globalyst 250**

AT&T's Globalyst entries were strong competitors when we last visited notebooks six months ago, and that fact has not changed. The $5,163 Globalyst 250, one of two AT&T units reviewed in this roundup, is a DX4/75-based system perfect for mobile presentations: It offers a brilliant active-matrix color display, a built-in microphone with integrated speakers, 16-bit audio playback and record capabilities, and an optional multimedia docking station. In December, the units will also begin supporting 24-bit color.

Other features stand out as well. Its integrated trackball is placed on the front edge of the notebook and may be an acquired taste. As in a previous iteration, the unit has one Type II and one Type III PCMCIA slot, so you can use your Type II and Type III peripherals simultaneously.

AT&T seems to be paying particular attention to battery issues by offering a new "gas gauge" on each battery to monitor its life. It is also one of

few vendors to offer users the option of replacing the unit's floppy disk drive with a second battery pack.

The 8-pound 4-ounce 250 came configured with 8MB of RAM and a removable 540MB hard disk, expandable to 40MB and 810MB, respectively. The unit posted mediocre battery scores (1 hour 36 minutes), probably thanks to its power-hungry active-matrix display, but performed well on all of the benchmark tests—especially the Winstone 95 and Graphics WinMark 95 tests, where it achieved above-average results. The 250 is backed with a three-year parts-and-labor warranty and a 30-day money-back guarantee if you buy your system directly from AT&T.—*AH*

AT&T Globalyst 250

	Windows applications	DOS applications	Road warrior	Desktop replacement
AT&T 250	GOOD	GOOD	GOOD	EXCELLENT

▶ **AT&T Globalyst 250.** AT&T Global Information Solutions, *Dayton, OH; 800-225-5627, 513-445-2000.*

Circle 449 on reader service card

Broadax Systems Inc.
- **BSI GN8549D**

CTX International Inc.
- **CTX EzBook DX4/75**
- **CTX EzBook DX4/100**

Broadax Systems (BSI) is a name we've seen before in the notebook market, and the company's newest offering, the BSI GN8549D, is very reasonably priced at $2,750 for an average-performing DX4/100-based system. CTX International just last July added notebooks to its monitor and LCD panel offerings; and with average prices and near-average performance, the CTX EzBook DX4/75 ($3,799) and the CTX EzBook DX4/100 ($3,999) are a good start.

In terms of battery life, dual-scan systems normally have the advantage over active-matrix systems, but BSI's notebook breaks this rule of thumb. The dual-scan GN8549D ran for 1 hour 45 minutes on our WinDrain test. That's about an hour less than the dual-scan EzBook DX4/75 and the active-matrix EzBook DX4/100.

All three units come with easily removable hard disks. BSI and CTX included 328MB hard disks with the GN8549D and EzBook DX4/75, respectively; the EzBook DX4/100 came with a 520MB hard disk. BSI offers hard disks up to 520MB, and CTX offers a 720MB hard disk with its systems.

In most other ways, these three notebooks are similar. Each of these portables includes a hot-swappable, smart nickel hydride battery pack. A button and a five-light indicator on the battery make it possible to find out how much charge is left. These notebooks also include one Type III slot and one Type II slot that can be used simultaneously.

If you're into multimedia, you'll appreciate the preinstalled audio applications, 16-bit stereo sound, and built-in microphone. While the 7-pound-7-ounce travel weight for these machines is about average for full-size notebooks, you will have to lug around a 1-pound-5-ounce (larger-than-average) AC power adapter when you hit the road.

In terms of component upgradability, we get a mixed message. BSI claims its unit is user-upgradable. This is supported by the fact that a removable keyboard exposes about half the motherboard, including the CPU and a RAM expansion slot. The catch is that you have to unplug the power to the display to access the expansion slot, at the risk of bending the pins on the display's power cable. While CTX admits that users could upgrade their EzBooks, it strongly encourages users to send their notebooks back to the factory for upgrades.

Test results for the three units were mixed. The GN8549D and the EzBook DX4/100's Winstone 95 scores fall on the borderline between average and below average, with BSI barely edging out CTX. Below-average CPUmark$_{16}$ scores for the DX4/100 systems pulled their Winstone scores down, but BSI installed Windows for Workgroups 3.11 on its system. This helped the GN8549D produce an above-average Disk WinMark 95 score and gave it an edge over the EzBook DX4/100. On Graphics WinMark 95 tests, the advantage was reversed: The EzBook DX4/100 scored average while the GN854ND was below average. The EzBook DX4/75 had above-average scores on our Graphics WinMark tests, below-average scores on our Disk WinMark tests, and average Winstone scores for its class.

CTX offers a three-year parts-and-labor warranty with its systems, excluding the battery and LCD, which are covered for one year. In case of repairs, the company also guarantees a 48-hour turnaround time within the warranty period. BSI provides a parts-and-labor warranty for one year, and returns serviced notebooks after about five working days.—*JLW*

CTX EzBook DX4/100

	Windows applications	DOS applications	Road warrior	Desktop replacement
BSI GN8549D	GOOD	GOOD	GOOD	FAIR
CTX EzBook DX4/75	FAIR	GOOD	EXCELLENT	FAIR
CTX EzBook DX4/100	GOOD	GOOD	EXCELLENT	GOOD

▶ **BSI GN8549D.** Broadax Systems Inc., *El Monte, CA; 800-872-4547, 818-442-0020; fax, 818-442-4527.*

Circle 451 on reader service card

▶ **CTX EzBook DX4/75, CTX EzBook DX4/100.** CTX International Inc., *Walnut, CA; 800-888-9052, 909-595-6146; fax, 909-595-6293.*

Circle 454 on reader service card

Broadax Systems Inc.
- **BSI NP7549D**

DTK Computer Inc.
- **DTK DTN-4T100P**

Summit Micro Design Inc.
- **Summit Mount Hood**
- **Summit Mount Rainier**

The $2,620 BSI NP7549D from Broadax Systems, the $2,800 (estimated selling price) DTN-4T100P from DTK, and the $3,350 Mount Rainier DX4/100 and $2,350 Mount Hood DX2/66 from Summit Micro Design were generally moderate performers, although they were below average in their respective processor classes. If you don't mind the 8-pound travel weight, they do offer decent battery life and have some sound capabilities and large displays. But there are other reviewed systems at both of these processor levels that offer more functionality and better performance for comparable prices.

The units had displays that measure an impressive 10 inches diagonally, except for the Mount Rainier system with a 9-inch display. The Summit Mount Hood is the only active-matrix unit in the group; the others all have dual-scan passive-matrix color displays. The Mount Hood is also the only system in this group based on the 486DX2/66 processor; the remaining three are all DX4/100-based units. The Mount Hood weighs 8 pounds 3 ounces and has a battery life of 1 hour 58 minutes, which was one of the best in its processor group.

The BSI NP7549D weighed in at 8 pounds 5 ounces and ran for 2 hours 28 minutes on our WinDrain test, which is competitive at any processor level in this roundup. The 8-pound-8-ounce Mount Rainier ran for 1 hour 56 minutes—also a strong result. The 8-pound-1-ounce DTN-4T100P's battery life ran close behind the Mount Rainier unit's, coming in at 1 hour 52 minutes.

The overall design of these four systems is, in a word, bulky. Their 8-pound weights aside, these four systems are just not comfortable to carry. Their design includes a built-in floppy disk drive, an integrated trackball, and an easily removable hard disk. There are integrated speakers as well as ports for external speakers. Two PCMCIA slots on all the units' side can accommodate one Type III card or two Type II cards.

System memory for all the units maxes out at 36MB. The memory modules are proprietary but can be bought through each of these companies. Upgrading the memory is relatively easy once you figure out how to do it (the process is not documented in any of the manuals).

Summit Mount Rainier

	Windows applications	DOS applications	Road warrior	Desktop replacement
BSI NP7549D	GOOD	GOOD	GOOD	FAIR
DTK DTN-4T100P	GOOD	GOOD	GOOD	GOOD
Summit Mount Hood	GOOD	FAIR	GOOD	GOOD
Summit Mount Rainier	GOOD	GOOD	GOOD	GOOD

All the units were tested with 8MB of RAM and three of the four were configured with 344MB IBM hard disks. The DTK system was the exception: It had a 343MB Conner hard disk installed. The maximum hard disk size available from each company varied slightly as well: Broadax and DTK offer 520MB hard disks while Summit offers a slightly larger 540MB hard disk. The units integrated a Cirrus Logic graphics accelerator chip set that is capable of handling external resolutions of 1,024 by 768 pixels; DTK was again an exception, as its chip set can handle a 1,280- by 1,024-pixel external resolution.

On our benchmark tests, the 100-MHz systems did not perform very competitively within their processor group. The BSI NP7549D managed an above-average Disk WinMark 95 score but fell below the average on the Graphics WinMark 95 and Winstone 95 tests. The DTN-4T100P posted average Winstone scores and below-average scores on our remaining Windows-based tests; the Mount Rainier 486DX4/100 achieved similar results.

The Mount Hood 486DX2/66 fared a little better. It posted average scores on all our Windows-based tests, compared with the DX2/66 processor group.

Warranties on each system vary slightly from company to company with no one company giving you the complete coverage you might find from other vendors. Broadax offers a one-year warranty that includes parts and labor but the vendor has no on-site service. DTK's support mirrors that of Broadax with minor differences. Summit presents you with the best warranty of this group by offering one year of on-site service for an additional $50; its technical support also adds Saturday coverage.

The below-average performance of these systems, combined with their relative bulk and 8-pound weight, makes them hard to recommend even though their battery life is impressive. There are a number of systems in this roundup that are lighter and offer better performance and a comparable battery life.—*WPF*

▶ **BSI NP7549D.** Broadax Systems Inc., *El Monte, CA; 800-872-4547, 818-442-0020; fax, 818-442-4527.*

Circle 451 on reader service card

▶ **DTK DTN-4T100P.** DTK Computer Inc., *City of Industry, CA; 800-289-2385, 818-810-0098; fax, 818-810-0090.*

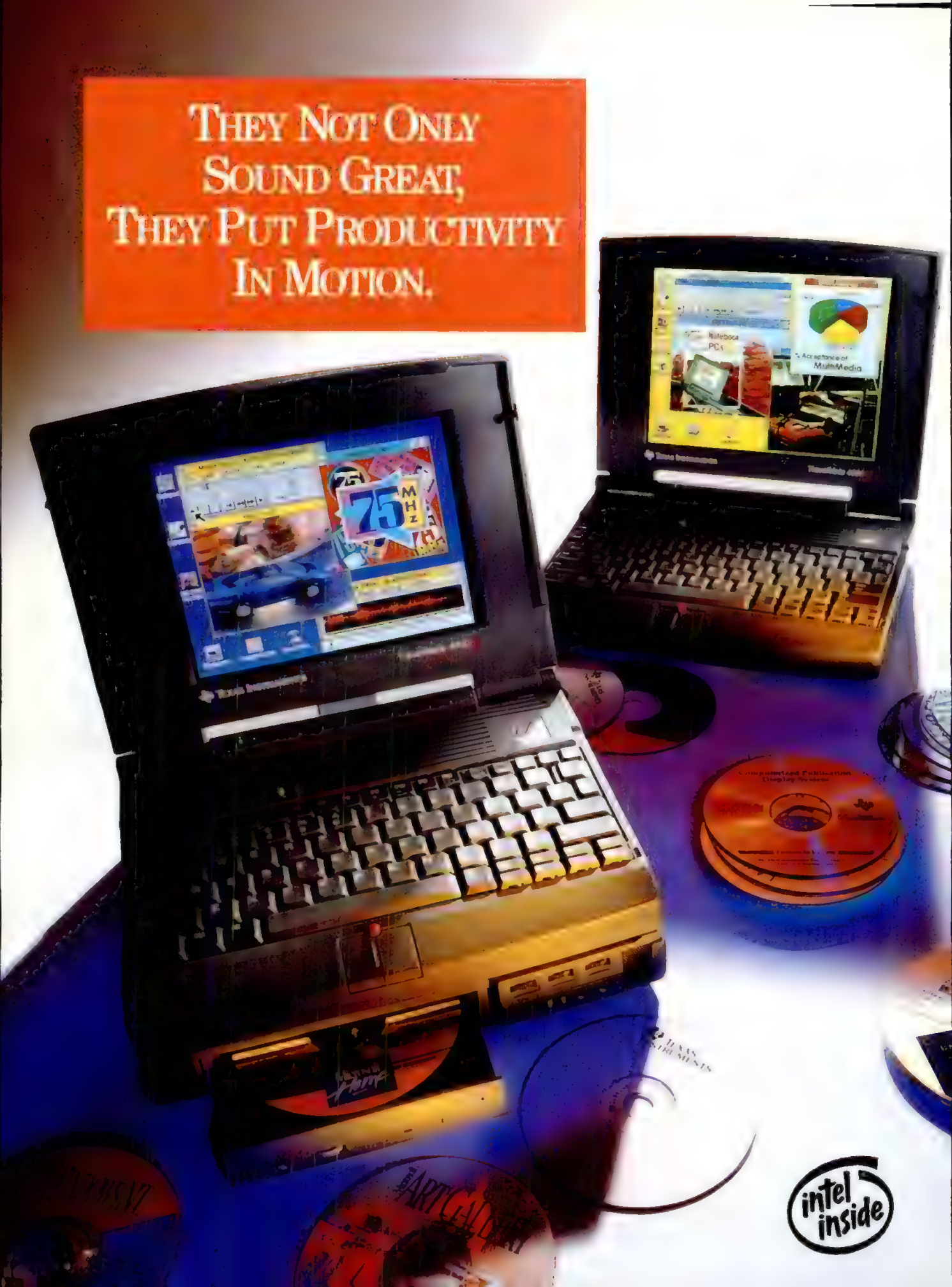
Circle 456 on reader service card

▶ **Summit Mount Hood, Summit Mount Rainier.** Summit Micro Design Inc., *Sunnyvale, CA; 800-288-5828, 408-739-6348; fax, 408-739-4643.*

Circle 473 on reader service card

Compaq Computer Corp.
- **Compaq Contura 400C**
- **Compaq Contura 400CX**

The $3,575 Contura 400CX and the $2,875 Contura 400C from Compaq Computer Corp. add a number of new features to already well-designed value-line notebooks. First, users will notice that Compaq moved the integrated trackball from the unit's side to its center, below the keyboard, and increased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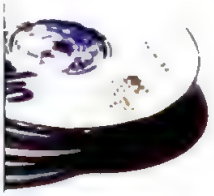

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CIRCLE 304 ON READER SERVICE CARD

its size. Second, the plug is now built into the side of the AC adapter, making it a one-piece unit. Though not an innovation of the same magnitude as the high-end LTE Elite line (which integrates these components into the system itself), this is still more convenient. More significant is the fact that many of the units' components, from the 250MB Quantum hard disks to the Intel 486DX2/40 processors (the only reviewed units with this CPU) and the displays, are now all user-upgradable.

Each system has a travel weight of 6 pounds 9 ounces, which is comparatively light. For added convenience, Compaq has added a clip-on handle that makes this already portable machine more so (however, there is no cover for rear expansion ports). The basic difference between the two systems is in the display: The Contura 400CX has an 8.5-inch active-matrix color display while the Contura 400C features a 9.5-inch dual-scan passive-matrix screen.

Remove a few screws and the hard disk can be taken out and upgraded. You can do the same for the processor, which can be upgraded to a 486DX2/50 for $499. Memory upgrades require the removal of only one panel and can be done in a few minutes. Each system has two integrated PCMCIA slots, which can hold either one Type III card or two Type II cards. Further expansion/upgrade options include a docking station with Ethernet for $299.

The systems had good battery life. The Contura 400CX lasted 2 hours 49 minutes, while the Contura 400C yielded battery life of 2 hours 52 minutes. These WinDrain times were among the best in this roundup at any level.

On our benchmark tests, the Conturas performed well and competed strongly with many of the 486DX2/50-based systems in this review. The units' Winstone 95 scores were on a par with those of other 486DX2/50s. The Conturas' CPUmark$_{16}$ scores mirrored each other, as did their Disk WinMark 95 scores. The active-matrix 400CX posted a slightly better Graphics WinMark 95 score than did the dual-scan 400C.—*WPF*

▶ **Compaq Contura 400C, Compaq Contura 400CX.** Compaq Computer Corp., *Houston, TX; 800-345-1518; fax, 713-378-1442.*

Circle 453 on reader service card

Compaq Contura 400CX

	Windows applications	DOS applications	Road warrior	Desktop replacement
Compaq Contura 400C	FAIR	FAIR	GOOD	FAIR
Compaq Contura 400CX	FAIR	FAIR	GOOD	GOOD

Compaq Computer Corp.

• Compaq Contura Aero 4/33c Model 170

The $2,147 Contura Aero 4/33c Model 170 from Compaq Computer Corp. has a few suprises, including a bright passive-matrix color display that rivals those seen on some full-size notebooks, and an integrated trackball. It also has a nice travel weight of 5 pounds 6 ounces. But its 170MB hard disk offers barely enough storage even for those users looking for functional partners for their desktops rather than for desktop replacements. Additionally, it is hampered by performance trade-offs (its Winstone 95 performance was one of the poorest we've seen), and its design has never caught on with buyers.

The Aero has one Type II PCMCIA slot. Most would probably use it for a modem, but this slot must also be used to connect to the Aero's external floppy disk drive. The unit has three ports in the rear: one serial, one parallel, and one for a $36 mobile port expander or a $99 desktop convenience base. Both the base and the port expander provide connections for an external monitor, printer, keyboard, and PS/2 mouse so you don't have to disconnect external equipment each time you remove your notebook. The desktop convenience base unit can also charge the system's battery as well as a spare.

Compaq Contura Aero 4/33c Model 170

	Windows applications	DOS applications	Road warrior	Desktop replacement
Compaq Aero	POOR	POOR	GOOD	FAIR

The Aero was the only Intel 486SXJ/33-based system in this roundup. (This CPU is hampered by a 16-bit data path.) The unit's CPUmark$_{16}$ score was competitive with the three other systems using 33-MHz CPUs, but on our Windows-based tests, the Aero was considerably outmatched. The Aero's Winstone score did not reach double digits, which means that it performed worse than our base 386/25, 4MB system. Its Disk WinMark 95 and Graphics WinMark 95 scores were also well below those of other comparable systems. The unit's battery lasted 2 hours 5 minutes on our WinDrain test.—*WPF*

▶ **Compaq Contura Aero 4/33c Model 170.** Compaq Computer Corp., *Houston, TX; 800-345-1518; fax, 713-378-1442.*

Circle 453 on reader service card

Compaq Computer Corp.

• Compaq LTE Elite 4/50CX Model 340

• Compaq LTE Elite 4/75CX Model 340

By integrating the AC adapter into the body of its LTE Elite line of notebook systems, Compaq Computer Corp. has increased the versatility of the notebooks without increasing their weight. With travel weights of 6 pounds 15 ounces each, the $5,999 Elite 4/75CX and the $5,299 Elite 4/50CX are among the lightest full-size notebooks in their CPU

classes and in this roundup. Unfortunately, these systems are also among the most expensive in this roundup and each system's performance on our benchmark tests was not very competitive within its CPU class.

The only indication of the integrated adapter is a fan at the back of the system. This new incarnation of the LTE line has also incorporated two Type II PCMCIA slots or one Type III slot, as well as plug-and-play capability. The LTE Elite notebooks can configure a number of devices, including many PCMCIA cards and an external monitor, without requiring you to reboot the system.

Both systems have a 9.5-inch active-matrix color display, with graphics subsystems powered by Western Digital chip sets. Both Elites included a 340MB hard disk, which is removable at the press of a button. The integrated trackball is positioned at the lower right side of the display with the actuation buttons located on the back side of the case. About the only high-end features missing from these systems are built-in sound capability and a 10.4-inch display.

Our benchmark tests proved that performance does not neccessarily follow design. The LTE Elites are well built, but in terms of Windows performance both systems were below average within their respective processor classes. The units' CPUmark$_{16}$ scores were average for their respective groups but both the Elite 4/75CX and the Elite 4/50CX posted below-average scores on our Disk WinMark 95, Graphics WinMark 95, and Winstone 95 tests. Both systems, which use nickel hydride batteries, lasted just over 2 hours on our WinDrain test. This result is good for both systems but is especially good for the Elite 4/75CX, given its processor level.

Compaq LTE Elite 4/75CX Model 340

	Windows applications	DOS applications	Road warrior	Desktop replacement
Compaq Elite 4/50CX	FAIR	FAIR	GOOD	FAIR
Compaq Elite 4/75CX	GOOD	FAIR	GOOD	GOOD

The LTE Elite systems are versatile and unique; unless you have to have multimedia capabilities and top performance, they offer one of the most functional designs in this roundup.—*WPF*

▶ **Compaq LTE Elite 4/50CX Model 340, Compaq LTE Elite 4/75CX Model 340.** Compaq Computer Corp., *Houston, TX; 800-345-1518; fax, 713-378-1442.*

Circle 453 on reader service card

▶ SUMMARY OF FEATURES CONTINUES

Color Portables

System weight, travel weight The system weight includes the weight of the battery. The travel weight adds that of the AC adapter brick and power cord, and in some cases, that of an external floppy disk drive as well.

Key size, distance between keys Key size is the horizontal distance across the flat top of a letter or number key. The distance between keys is determinded by measuring the horizonal distance from the top edge of one key to the top edge of its neighboring key.

Type of pointing device installed Each unit had an integrated trackball, a clip-on trackball, an integrated pointing stick (which may sit between keys on the keyboard or replace a trackball on the wrist rest), an integrated touchpad (a pressure- and direction-sensitive surface), an integrated mouse (which likely pops out of compartment in the notebook), or a J-key (a normal letter key that provides directional sensitivity when depressed and held down).

On-site service If a vendor offers on-site service for its notebooks, we list the cost of that service and the period of time that the on-site service warranty is valid. In some cases, service is included as part of the warranty. Some vendors offer free replacement of a notebook in lieu of on-site service.

Video chip set manufacturer The video chip set affects the maximum external resolution and the number of simultaneous colors an external monitor can display at that resolution.

PCMCIA slots accept removable credit card-size devices, such as modems, or cards for expansion memory or for storage through nonvolatile static RAM for hard disks.

Modem type installed indicates the type of modem sent with the computer. We list the maximum data and fax communication speeds.

The systems in this roundup all include power-conservation features, such as automatic **display** dimming or blanking, automatic **hard disk power-down,** slowing or halting of the **CPU,** and **peripherals power-down** for cutting off power to the I/O ports when the machine is not in use. More advanced power management features include **standby** mode (in which the system preserves its current state in memory, usually via a secondary battery) and **hibernation** (in which the system's state is written to the hard disk, ensuring that the system retains information if battery power fails).

CTX International Inc.
• **CTX EzNote 486DX/33**
Ergo Computing Inc.
• **Ergo SubBrick 33**

Good subnotebooks should never be so heavy that users have to make conscious decisions on whether or not to bring them along—they should just be taken. The CTX's EzNote 486DX/33 and Ergo's SubBrick 33 are odd as subnotebooks go, in that their individual travel weights nearly match those of full-size machines. The culprits are their external floppy disk drives, which are considerably heavier than most.

At 6 pounds 8 ounces with external floppy disk drive and with a battery life of 2 hours 15 minutes, the $2,495 SubBrick does not make itself easy to bring along. At $1,699 and 6 pounds 9 ounces with its floppy disk drive and a tested battery life

▶ SUMMARY OF FEATURES CONTINUES

Color Portables

Products listed in alphabetical order ■ = YES □ = NO	AMS SoundPro DX4/75	AMS SoundPro DX4/100	AMS SoundWave	Aquilino Cruiser	ARMNote TS30ME	ARMNote TS30PS	Aspento 66/66	Aspen Universe-E Series
List price (tested configuration)	$2,295	$3,995	$3,695	$5,935	$4,449	$4,599	$4,220	$3,100
Processor type and speed	Intel DX4/75	Intel DX4/100	Intel DX4/100	Intel DX4/75	Intel DX4/100	Pentium/90	Pentium/66	Intel DX4/100
Dimensions (HWD, in inches)	2.1 x 11 x 8.1	2.3 x 11 x 8.5	1.8 x 11.3 x 8.5	2.3 x 11.5 x 9	1.9 x 11 x 8.5	2 x 11 x 8.5	2.5 x 11 x 10.3	2.3 x 11 x 8.8
System weight, travel weight	6 lbs. 11 oz., 7 lbs. 14 oz.	6 lbs. 15 oz., 8 lbs. 2 oz.	5 lbs. 15 oz., 7 lbs. ❶	7 lbs. 4 oz., 8 lbs. 7 oz.	6 lbs. 11 oz., 7 lbs. 14 oz.	6 lbs. 8 oz., 7 lbs. 12 oz.	8 lbs. 10 oz., 9 lbs. 13 oz.	7 lbs. 2 oz., 8 lbs. 5 oz.
Display area and diagonal (inches)	5.6 x 7.5, 9.4	5.8 x 7.8, 9.5	5.8 x 7.8, 9.5	5.2 x 6.8, 8.5	5.8 x 7.8, 9.5	6 x 8.3, 10.3	5.7 x 7.5, 9.5	5.8 x 7.8, 9.5
Key size, distance between keys (millimeters)	13, 7	12, 7	12, 7	12, 5	13, 6	12, 7	12, 6	13, 6
Type of pointing device installed	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball
DOS, Windows version included	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.2, Windows 3.11	DOS 6.2, Windows 3.1	DOS 6.2, WfWG 3.11	DOS 6.22, Windows 3.1	DOS 6.2, Windows 3.11
Warranty on parts/labor	3 years/3 years	3 years/3 years	3 years/3 years	5 years/5 years	1 year/3 years	1 year/3 years	1 year/2 years	1 year/2 years
On-site service	None	None	None	$299.00 (5 years)	$279.00 (4 years)	$279.00 (4 years)	None	None
Components								
Motherboard manufacturer	AMS	AMS	ACC	Aquilino	Compal	Compal	Kapok	Kapok
Chip set manufacturer	ACC	ACC	ACC	OPTi	Pico Power	VLSI	OPTi	SIS
BIOS version (or date)	Phoenix 1.03	Phoenix (4/19/90)	Phoenix (4/19/90)	Phoenix (8/29/94)	SystemSoft 1.05	Phoenix (9/27/94)	AMI (6/06/92)	Award (4/28/94)
Flash BIOS/16550 UART support	■■	■■	■□	□■	■□	■■	■■	■□
Installed/maximum system RAM	8MB, 32MB	8MB, 32MB	8MB, 20MB	16MB, 24MB	20MB, 20MB	24MB, 40MB	8MB, 40MB	8MB, 36MB
Installed/maximum external cache	128K, 128K	128K, 128K	N/A	N/A	N/A	256K, 256K	N/A	128K, 128K
Installed/maximum hard disk size	245MB, 800MB	344MB, 800MB	333MB, 800MB	523MB, 810MB	527MB, 810MB	250MB, 720MB	344MB, 800MB	343MB, 800MB
Screen manufacturer	Hitachi	NEC	NEC	Sharp	NEC	Sanyo	NEC	NEC
Screen type	Dual-scan color	Active color	Active color	Active color	Active color	Dual-scan color	Active color	Dual-scan color
Graphics chip set manufacturer	WD	WD	WD	C&T	C&T	C&T	Cirrus Logic	Cirrus Logic
Graphics RAM and type	1MB VRAM	1MB VRAM	1MB VRAM	1MB DRAM	1MB VRAM	1MB VRAM	1MB DRAM	1MB VRAM
Simultaneous external display	■	■	■	■	■	■	■	■
PCMCIA slots	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	One Type II and one Type III	Two Type II or one Type III
Modem type installed	None	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	None	None	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax
Power								
Rated charge time while on, off (hours:minutes)	7:00, 2:00	7:00, 2:00	6:15, 2:00	1:30, 1:30	3:40, 1:50	2:00, 1:30	2:00, 2:00	N/A, 1:30
Display/hard disk power-down	■□	■■	■■	■■	■■	■■	■■	■■
CPU/peripheral power-down	■□	■■	■■	■□	■■	■□	□□	□□
Standby/hibernation mode	■■	■■	■■	□■	■■	■■	□□	□□

N/A—Not applicable. The product does not have this feature. ❶ The travel weight includes the weight of the external floppy disk drive.
ACC—ACC Micro Electronics Inc., AMS—American Multisystems, BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DTI—Display Technologies Inc., FIC—First International Computer Inc., HP—Hewlett-Packard Co., NTC—Nan Tan Computer Co., SIS—Silicon Integrated Systems Corp., TI—Texas Instruments Inc., Vendata—Vendata Electronics Inc., WD—Western Digital Corp., ZDS—Zenith Data Systems

of 2 hours 49 minutes, the EzNote barely makes that decision any easier. However, the systems did prove themselves to be competitive performers.

The units' 7.8-inch dual-scan display suffered from slight ghosting at the base of the screen. The integrated trackball, located to the right of the Spacebar, was so small it only took up the space of a single key. Its actuation buttons were separate keys with mouse icons on them and were comfortable to use. Two PCMCIA slots can hold two Type II cards or one Type III card.

Ergo SubBrick 33

	Windows applications	DOS applications	Road warrior	Desktop replacement
CTX EzNote	FAIR	FAIR	EXCELLENT	FAIR
Ergo SubBrick	FAIR	FAIR	GOOD	FAIR

Both systems are built around the Cyrix Cx486DX/33 processor; they are the only ones so built in this roundup. Both units had nearly identical scores on our benchmark tests and, given their 33-MHz processor, both performed well, in line with what we would expect for this processor level. They bested the other two 33-MHz units on both the Winstone 95 and Graphics WinMark 95 tests as well as on all DOS-based tests, and were average performers on the Disk WinMark 95 tests (the EzNote did a bit better than the SubBrick here). Not suprisingly, the SubBrick's $CPUmark_{16}$ score was identical to the EZNote's but slightly below that of the Compaq Aero,

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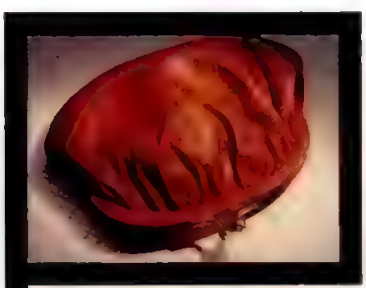

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□ ***Venturis 4100*** *(486DX4/100MHz)* ***$2,098*** *$73/mo. lease*

□ ***Venturis 560*** *(Pentium) Call for specs.* ***$2,098*** *$73/mo. lease*

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- *3 ISA expansion slots (2 full-size, 1 half-size)*
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* Three-year limited hardware warranty. Certain restrictions and exclusions apply. **July 1994 issue.

which ran with an Intel 486SX/33 processor.

Of the two, the CTX EzNote is more cost-efficient but either unit's travel weight will put off most users. This is especially true in light of the fact that there are other subnotebooks (and full notebooks) in this roundup that are comparably priced and better designed.—*WPF*

▶ **CTX EzNote 486DX/33.** CTX International Inc., *Walnut, CA; 800-888-9052, 909-595-6146; fax, 909-595-6293.*

Circle 454 on reader service card

▶ **Ergo SubBrick 33.** Ergo Computing Inc., *Peabody, MA; 800-633-1925, 508-535-7510; fax, 508-535-7512.*

Circle 458 on reader service card

Dell Computer Corp.
- **Dell Latitude XP 450C**
- **Dell Latitude XP 4100CX**

The $5,099 Dell Latitude XP 4100CX and the $3,199 Dell Latitude XP 450C represent the high end of Dell's Latitude notebook line. On the whole, however, the Latitude XP and Dell's Latitude value line (the latter is reviewed separately) match up evenly in terms of design, features, and battery life. There are only two reasons to consider the XP line: the increased processing speed granted by the XP 4100CX's DX4/100 processor and the long life of the systems' lithium ion batteries.

The XP 4100CX incorporates an active-matrix color display, has a travel weight of 7 pounds, and uses the Western Digital 90C24A2 graphics accelerator chip set. The 486DX2/50-based XP 450C has a dual-scan passive-matrix display and a travel weight of 6 pounds 13 ounces and employs the Western Digital Rocket chip set. Two Type II PCMCIA slots (or one Type III PCMCIA slot) and a removable hard disk are also part of this line's package.

These are the only two tested systems with "smart" lithium ion batteries installed. Each has a charge light on it that indicates at a glance how much power is in the battery. The XP 4100CX lasted 2 hours 19 minutes on our WinDrain test, which is relatively competitive at this processor level. The XP 450C lasted an impressive 3 hours 31 minutes on our WinDrain test—second only to the Toshiba Portégé T3600CT (which lasted 3 hours 58 minutes). Keep in mind, however, that standard Latitudes (as well as the AST Ascentia 800N) have removable floppy disk drives for use with an optional second battery.

There is a trade-off with Latitude XPs—gains in battery life are counterbalanced by slight dips in performance: The XP 450C did not perform quite as well as the Dell Latitude 450C or the Dell Latitude 450CX on our benchmark tests. (All three were similarly configured except for their graphics accelerator chip sets.) On our Windows-based benchmark tests, the XP 450C posted an outstanding Disk WinMark 95 score relative to this processor group; however, the system's Winstone 95 score and Graphics WinMark 95 score were both average. The XP 4100CX posted average Winstone and Disk WinMark scores and an above-average Graphics WinMark score. The other Latitude systems were consistently above average on each set of tests.—*WPF*

Dell Latitude XP 4100CX

	Windows applications	DOS applications	Road warrior	Desktop replacement
Dell XP 450C	FAIR	FAIR	EXCELLENT	GOOD
Dell XP 4100CX	GOOD	GOOD	GOOD	GOOD

▶ **Dell Latitude XP 450C, Dell Latitude XP 4100CX.** Dell Computer Corp., *Austin, TX; 800-613-3355, 512-338-4400; fax, 800-727-8320.*

Circle 455 on reader service card

Everex Systems Inc.
- **Everex Step Note DX2/50**

The $2,590 Everex Step Note from Everex Systems is an attractively designed system that combines solid performance in a Windows environment with 8-bit sound capabilities (including an internal speaker and microphone) for an enticing price. The unit's 2-hour battery life is also a nice plus.

Everex Step Note DX2/50

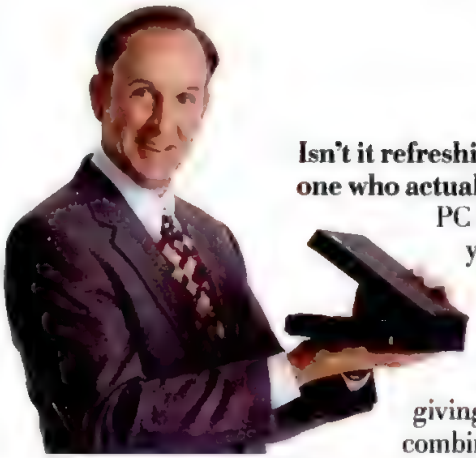
	Windows applications	DOS applications	Road warrior	Desktop replacement
Everex Step Note	FAIR	FAIR	GOOD	FAIR

The Step Note's travel weight is 7 pounds 5 ounces. Its dual-scan passive-matrix color display is surprisingly bright and measures 9.5 inches diagonally. The unit's integrated trackball is centered conveniently under the keyboard and its buttons are easily accessed. The 340MB hard disk is removable, as is the floppy disk drive—but for no apparent reason. Everex Systems initially intended to manufacture some modules for the space left by the floppy disk drive, but with the popularity of PCMCIA on the rise, the company decided against it. The next version of the Step Note will allow the floppy disk bay to be used by a second battery.

In a cryptic twist, this machine requires you to hit Fn-Enter to turn the system on and Fn-Alt-Home to turn it off. There is a sticker on the system that describes this procedure but it could be removed or peeled off.

The Step Note had a Winstone 95 score that was above average for its processor class. Its CPUmark$_{16}$ score was average for its processor class, but its Disk WinMark 95 score was below average. With help from its Western Digital graph-

A road map for the



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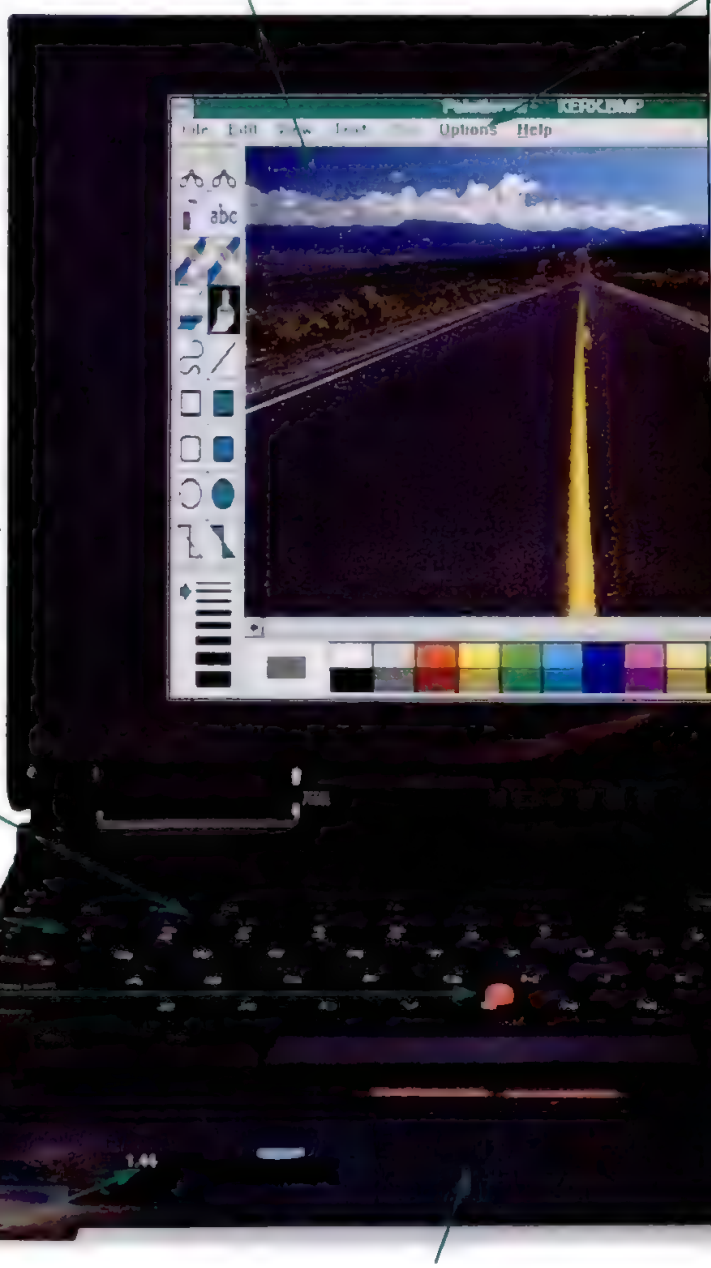

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SUMMARY OF FEATURES

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PC MAGAZINE EDITORS' CHOICE

Products listed in alphabetical order ■ = YES □ = NO	AST Ascentia 800N	AST Ascentia 900N	AT&T Globalyst 200	AT&T Globalyst 250	Austin Business Audio DX4/100	BSI GN8549D	BSI NP3656T Pentium	BSI NP7549D
List price (tested configuration)	$2,806	$5,098	$3,985	$5,163	$4,615	$2,750	$3,545	$2,820
Processor type and speed	Intel 486DX2/50	Intel DX4/75	Intel DX4/75	Intel DX4/75	Intel DX4/100	Intel DX4/100	Pentium/66	Intel DX4/100
Dimensions (HWD, in inches)	1.7 x 10.4 x 8.8	2 x 11.5 x 8.5	2.3 x 11 x 9	2.2 x 11.5 x 9.3	2.3 x 11 x 8.5	2.1 x 11.3 x 8.4	2.5 x 11 x 10.3	2.5 x 11 x 9.5
System weight, travel weight	5 lbs. 14 oz., 6 lbs. 6 oz.	6 lbs. 9 oz., 7 lbs. 13 oz.	6 lbs. 8 oz., 7 lbs. 4 oz.	6 lbs. 14 oz., 8 lbs. 4 oz.	7 lbs., 8 lbs. 4 oz.	6 lbs. 3 oz., 7 lbs. 7 oz.	8 lbs. 14 oz., 10 lbs.	7 lbs. 1 oz., 8 lbs. 5 oz.
Display area and diagonal (inches)	5.8 x 7.7, 9.5	6.3 x 8.4, 10.4	6 x 8.3, 10.3	5.8 x 7.5, 9.5	5.8 x 7.8, 9.5	5.6 x 7.5, 9.5	5.8 x 7.5, 9.5	6 x 8.3, 10.3
Key size, distance between keys (millimeters)	12, 5	13, 8	13, 6	13, 6	12, 6	12, 7	12, 6	13, 6
Type of pointing device installed	Integrated trackball	Integrated pointing stick	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball
DOS, Windows version included	DOS 6.22, Windows 3.1	DOS 6.22, Windows 3.11	DOS 6.22, Windows 3.11	DOS 6.22, Windows 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11
Warranty on parts/labor	3 years/3 years	3 years/3 years	1 year/1 year	3 year/3 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year
On-site service	None	None	$50.00 (1 year)	$150.00 (3 years)	None	None	None	None
Components								
Motherboard manufacturer	Intel	AST	AT&T	NEC	IPC	CTX	NTC	NTC
Chip set manufacturer	Intel	VLSI	Pico Power	Pico Power	ACC	WD	OPTI	ACC
BIOS version (or date)	AST 1.06	AST/IBM [illegible]	Phoenix (6/10/94)	Phoenix (1/19/93)	Phoenix (4/19/90)	AMI (11/11/92)	AMI (6/06/92)	AMI (6/06/92)
Flash BIOS/16550 UART support	■■	■■	■■	■■	□■	■□	■■	■□
Installed/maximum system RAM	8MB, 20MB	8MB, 32MB	8MB, 20MB	8MB, 40MB	16MB, 32MB	8MB, 32MB	8MB, 40MB	8MB, 36MB
Installed/maximum external cache	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Installed/maximum hard disk size	340MB, 340MB	477MB, 510MB	349MB, 810MB	540MB, 810MB	488MB, 704MB	328MB, 520MB	340MB, 520MB	344MB, 520MB
Screen manufacturer	Sanyo	Hitachi	AT&T	NEC	Hitachi/Sharp	Sharp	NEC	Sanyo
Screen type	Dual-scan color	Active color	Active color	Active color	Active color	Dual-scan color	Active color	Dual-scan color
Graphics chip set manufacturer	WD	WD	WD	C&T	WD	WD	Cirrus Logic	Cirrus Logic
Graphics RAM and type	1MB DRAM	1MB VRAM	1MB VRAM	1MB VRAM	1MB VRAM	1MB DRAM	1MB DRAM	1MB DRAM
Simultaneous external display	■	■	■	■	■	■	■	■
PCMCIA slots	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	One Type II and one Type III	Two Type II or one Type III	One Type II and one Type III	One Type II and one Type III	Two Type II or one Type III
Modem type installed	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps internal fax	14,400-bps internal fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax
Power								
Rated charge time while on, off (hours:minutes)	2:30, 2:30	1:30, 1:00	N/A, 2:30	2:30, 1:15	4:00, 1:45	2:00, 2:00	2:00, 2:00	2:00, 2:00
Display/hard disk power-down	■■	■■	■■	■■	■■	■■	■■	■■
CPU/peripheral power-down	■■	■■	■■	■■	■■	■■	■□	■□
Standby/hibernation mode	■■	■■	□□	■■	■□	■■	■□	□□

N/A—Not applicable. The product does not have this feature. ❶ The travel weight includes the weight of the external floppy disk drive.

ACC—ACC Micro Electronics Inc., AMS—American Multisystems, BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DTI—Display Technologies Inc., FIC—First International Computer Inc., HP—Hewlett-Packard Co., NTC—Nan Tan Computer Co., SIS—Silicon Integrated Systems Corp., TI—Texas Instruments Inc., Veridata—Veridata Electronics Inc., WD—Western Digital Corp., ZDS—Zenith Data Systems

ics accelerator chip set, the Step Note logged an average score on the Graphic WinMark 95 tests.—*WPF*

▶ **Everex Step Note DX2/50.** Everex Systems Inc., *Fremont, CA; 800-383-7391, 510-498-1111; fax, 510-683-2186.*

Circle 459 on reader service card

Gateway 2000 Inc.

- **Gateway ColorBook DX2-50**
- **Gateway ColorBook DX4-75**

Gateway 2000 offers two of the lightest notebooks in this roundup (just over 7 pounds travel weight) for a reasonable price: The ColorBook DX4-75 is $3,499 and the ColorBook DX2-50 is $3,199. But their graphics performance was weak.

The two ColorBooks came with a 10.3-inch dual-scan display that was difficult to read—the picture was spotty and the brightness control didn't help much. The systems have an integrated trackball, which pulls out from a slot in front of the keyboard; some may find it difficult to use. The company does score points with its memory design. Memory, located above the keyboard, is accessed by an easily removable cover and is stackable. Our test units came with 8MB of RAM; the system maximum is 20MB.

To the right of the trackball is the 3.5-inch floppy disk drive, and to the left is the removable hard disk. Both ColorBooks came with a Toshiba 250MB hard disk; 340MB is the largest disk currently available. The PCMCIA slots are on the left side toward the back; two Type II cards (or one Type III card) can be accommodated. Both systems use nickel hydride batteries, which lasted 2 hours 12 minutes in the DX2-50 and just under 2 hours in the DX4-75 on our WinDrain test.

Compared with machines within its CPU class, the DX4-75 fared well. It posted an above-average score on the Disk WinMark 95 tests and average scores on the Winstone 95, CPUmark$_{16}$, DOSMark, and DOS Disk tests. Graphics, however, proved to be a problem for the DX4-75. Equipped with a Cirrus Logic chip set, the DX4-75 had below-average scores on the Graphics WinMark 95 and DOS Video tests.

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Windows system requirements: 386 or higher IBM compatible PC with 4 MB RAM. Windows 3.1 or higher. 10 MB free space on your hard disk and a VGA or better monitor. Works with any printer supported by Windows. QuickBooks is a registered trademark of Intuit Inc

SUMMARY OF FEATURES

CONTINUES

Products listed in alphabetical order ■ = YES □ = NO	BSI NPS249D	Commax SmartBook III	Compaq Contura 400C	Compaq Contura 400CX	Compaq Contura Aero 4/33c Model 170	Compaq LTE Elite 4/50CX Model 340	Compaq LTE Elite 4/75CX Model 340	CTX EzBook DX4/75
List price (tested configuration)	$2,745	$4,499	$2,875	$3,575	$2,147	$5,299	$5,999	$3,799
Processor type and speed	Intel DX4/100	Intel DX4/100	Intel 486DX2/40	Intel 486DX2/40	Intel 486SX/33	Intel 486DX2/50	Intel DX4/75	Intel DX4/75
Dimensions (HWD, in inches)	2.3 x 11 x 8.8	2.3 x 11 x 8.8	2 x 11.8 x 9	2 x 11.8 x 9	1.7 x 10.3 x 7.5	2 x 11.8 x 8.9	2 x 11.9 x 8.9	2 x 11.1 x 8.5
System weight, travel weight	6 lbs. 15 oz., 8 lbs. 2 oz.	7 lbs. 4 oz., 8 lbs. 7 oz.	5 lbs. 14 oz., 6 lbs. 9 oz.	5 lbs. 14 oz., 6 lbs. 9 oz.	4 lbs. 2 oz., 5 lbs. 6 oz. ●	6 lbs. 12 oz., 6 lbs. 15 oz.	6 lbs. 12 oz., 6 lbs. 15 oz.	6 lbs. 3 oz., 7 lbs. 7 oz.
Display area and diagonal (inches)	5.8 x 7.8, 9.5	5.8 x 7.8, 9.5	5.7 x 7.6, 9.5	5.1 x 6.5, 8.5	4.5 x 6.3, 7.8	5.7 x 7.6, 9.5	5.7 x 7.6, 9.5	5.7 x 7.6, 9.5
Key size, distance between keys (millimeters)	13, 6	12, 6	13, 6	13, 6	11, 6	12, 7	12, 7	12, 6
Type of pointing device installed	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball
DOS, Windows version included	DOS 6.22, WfWG 3.11	PC DOS 6.3, Windows 3.11	DOS 6.2, Windows 3.1	DOS 6.2, Windows 3.1	DOS 6.2, Windows 3.1	DOS 6.2, Windows 3.1	DOS 6.2, Windows 3.1	DOS 6.22, Windows 3.1
Warranty on parts/labor	1 year/1 year	1 year/1 year	3 years/3 years	3 years/3 years	3 years/3 years	3 years/3 years	3 years/3 years	3 years/3 years
On-site service	None	None	$149.00 (3 years)	$149.00 (3 years)	$149.00 (3 years)	$149.00 (3 years)	$149.00 (3 years)	None
Components								
Motherboard manufacturer	BSI	Commax	Compaq	Compaq	Compaq	Compaq	Compaq	Veridata
Chip set manufacturer	SIS	SIS	VLSI	VLSI	VLSI	VLSI	VLSI	WD
BIOS version (or date)	Award (8/05/94)	Award (9/06/94)	Compaq (8/28/94)	Compaq (8/28/94)	Compaq 9.02B	Compaq (7/28/94)	Compaq (7/28/94)	AMI (8/07/94)
Flash BIOS/16550 UART support	■□	□□	■■	■■	■■	■■	■■	■■
Installed/maximum system RAM	8MB, 36MB	16MB, 36MB	8MB, 20MB	8MB, 20MB	8MB, 12MB	8MB, 24MB	8MB, 24MB	8MB, 32MB
Installed/maximum external cache	128K, 128K	128K, 128K	N/A	N/A	N/A	N/A	N/A	N/A
Installed/maximum hard disk size	343MB, 520MB	527MB, 540MB	253MB, 253MB	255MB, 256MB	170MB, 250MB	340MB, 510MB	340MB, 510MB	326MB, 720MB
Screen manufacturer	Sanyo	NEC	Compaq	Compaq	Compaq	Compaq	Compaq	Sharp
Screen type	Dual-scan color	Active color	Passive color	Active color	Passive color	Active color	Active color	Dual-scan color
Graphics chip set manufacturer	Cirrus Logic	Cirrus Logic	WD	WD	Compaq	WD	WD	WD
Graphics RAM and type	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM	512K DRAM	1MB DRAM	1MB DRAM	1MB DRAM
Simultaneous external display	■	■	■	■	□	■	■	■
PCMCIA slots	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	One Type II	Two Type II or one Type III	Two Type II or one Type III	One Type II and one Type III
Modem type installed	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	None	None	None	None	None	None
Power								
Rated charge time while on, off (hours:minutes)	3:00, 3:00	N/A, 1:30	3:00, 1:30	3:00, 1:30	4:00, 2:30	1:30, 1:00	1:30, 1:00	3:00, 2:00
Display/hard disk power-down	■■	■■	■■	■■	■■	■■	■■	■■
CPU/peripheral power-down	□□	■□	■■	■■	■■	■■	■■	■■
Standby/hibernation mode	□□	□□	■■	■■	■■	■■	■■	■■

N/A—Not applicable. The product does not have this feature. ● The travel weight includes the weight of the external floppy disk drive.
ACC—ACC Micro Electronics Inc., AMS—American Multisystems, BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DTI—Display Technologies Inc., FIC—First International Computer Inc., HP—Hewlett-Packard Co., NTC—Nan Tan Computer Co., SIS—Silicon Integrated Systems Corp., TI—Texas Instruments Inc., Veridata—Veridata Electronics Inc., WD—Western Digital Corp., ZDS—Zenith Data Systems.

Gateway ColorBook DX4-75

	Windows applications	DOS applications	Road warrior	Desktop replacement
Gateway DX2-50	FAIR	FAIR	GOOD	FAIR
Gateway DX4-75	GOOD	GOOD	GOOD	FAIR

The DX2-50 managed an average score on the Winstone tests, partly because of an above-average Disk WinMark score. Its Graphics WinMark score was below average—not suprising, since it uses the same Cirrus Logic chip set as its sibling. The system's CPUmark$_{16}$ score was average, but its other three DOS-based test scores were below average.

Gateway offers a one-year parts and labor warranty; an optional extended warranty called the VIP warranty features 24-hour turnaround for one year. This means if something goes wrong, you remove your hard disk, send the notebook back, and Gateway will cross-ship so that you have your new machine in 24 hours.—*MEB*

▶ **Gateway ColorBook DX2-50, Gateway ColorBook DX4-75.** Gateway 2000 Inc., *North Sioux City, SD; 800-846-2000, 605-232-2000; fax, 605-232-2023.*

Circle 461 on reader service card

Hertz Computer Corp.

• **Hertz Z-Optima 486 Notebook PC**

The $3,184 Hertz Z-Optima 486 Notebook PC is backed by a generous three-year warranty on parts and labor (one year for the display), and offers a variety of ways to upgrade and expand the unit.

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intel inside

First year off the drawing board and the Ascentia™ 900N gets named "1994 Notebook of the Year" by *PC LapTop Computers Magazine*. Which shouldn't be any surprise when you consider what everybody's been saying:

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—*Windows Magazine, September '94*

PC WORLD

"...you don't expect a powerhouse to have a battery life of almost 6 3/4 hours as well!"

—*PC World, October '94 Best Buy Award.*

"Quite simply, the Ascentia outperformed the other four notebooks in this review. The more remarkable aspect of the Ascentia is its 10.4-inch Hitachi active-matrix color display."

—*PC Magazine, August '94*

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—*PC LapTop Computers Magazine, October '94*

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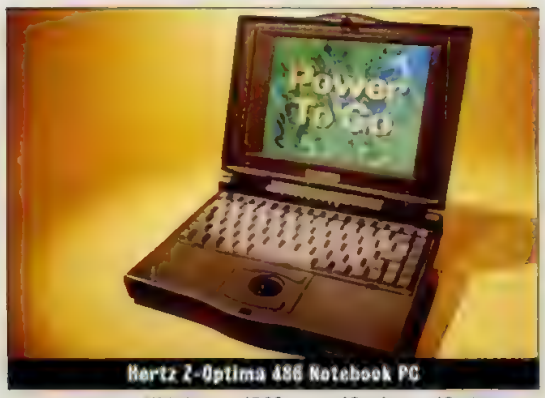
CIRCLE 215 ON READER SERVICE CARD



Hertz Z-Optima 486 Notebook PC

	Windows applications	DOS applications	Road warrior	Desktop replacement
Hertz Z-Optima	FAIR	FAIR	GOOD	FAIR

But it's only an average performer and has few distinguishing features.

This 486DX2/66-based unit comes with an integrated floppy disk drive, two Type II PCMCIA slots (which double as a single Type III slot), and a bright 9.5-inch dual-scan passive-matrix display that you can remove and upgrade to an active-matrix screen ($690). The keyboard is well laid out with a centrally located integrated trackball just below it; there is plenty of space for the palm rest. The Z-Optima came with a 341MB removable hard disk and 16MB of system memory.

The unit performed below the average for its CPU class on many of our DOS-, Windows-, and processor-based tests except for the Winstone 95 tests, where its score was average. This is no surprise since the system had twice the amount of RAM of most other units in its class. But the unit's DOS Video and Graphics WinMark 95 scores, influenced by its Cirrus Logic CL-GD6440 chip set, were particularly poor: They were next to last in this unit's CPU class in both cases.

The Z-Optima's 8-pound travel weight is heavier than average, but the unit had a respectable 2-hour battery life on our WinDrain test. That and its support for an optional docking station to improve expandability may help you decide that this is the right notebook to use both on the road and at the office.—*AH*

▶ **Hertz Z-Optima 486 Notebook PC.** Hertz Computer Corp., *New York, NY; 800-232-8737, 212-684-4141; fax, 212-684-3658.*

Circle 462 on reader service card

Hewlett-Packard Co.

EDITORS' CHOICE ▶ **HP OmniBook 600C**

Each iteration of Hewlett-Packard's OmniBooks has introduced improvements to the original ingenious design. The $3,780 (estimated street price) HP OmniBook 600C is no exception—in fact, it goes even further than its predecessors. While maintaining some of the line's best features, such as light weight (5 pounds 7 ounces with an external floppy disk drive), compact design, and instant on, HP has raised the power ante to a DX4/75 CPU and has included a brilliant and clear 8.5-inch dual-scan passive-matrix screen. With the OmniBook 600C, Hewlett-Packard has truly created an impressive lightweight system with most of the functionality of a full-size notebook.

Some of the ThinkPad's most intriguing features are powered by a single chip: IBM's Mwave MDSP2780.

The company does also sell full-size notebooks, the HP 4000s (not reviewed here), which have greater hard disks and RAM capacity and built-in sound.

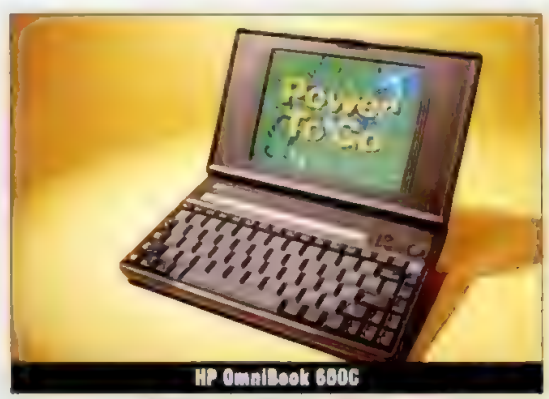
Aside from its DX4/75 CPU (a 486DX2/50 chip is also available), the HP OmniBook 600C had a 171MB PCMCIA hard disk and 16MB of RAM (system maximum). We recommend upgrading to the 260MB hard disk, an option that will cost you $300. There are two additional PCMCIA Type II slots (or one Type III slot) and an IrDA-compliant infrared port. The system's pop-out mouse has remained the same and is fairly easy to use—unless you are left-handed. (As in previous versions, its keyboard is full-size and very comfortable.)

The OmniBook kept up with its DX4/75 competition on our tests, posting above-average Winstone 95 and Disk WinMark 95 scores. But some of that credit must go to its 16MB of RAM; most other systems came with 8MB. On our WinDrain test, the OmniBook's nickel hydride battery managed 2 hours 46 minutes, putting it among the ten units with the longest battery life in this roundup.

Though there's no toll-free technical support, HP offers a one-year warranty that includes overnight exchange of defective products.—*Anush Yegyazarian*

▶ **HP OmniBook 600C.** Hewlett-Packard Co., *Corvallis, OR; 800-443-1254, 503-715-2004; fax, 503-715-5488.*

Circle 463 on reader service card



HP OmniBook 600C

	Windows applications	DOS applications	Road warrior	Desktop replacement
HP OmniBook 600C	GOOD	GOOD	EXCELLENT	GOOD

IBM Personal Computer Co.

EDITORS' CHOICE ▶ **IBM ThinkPad 755CD**

IBM's ThinkPad 755CD lives up to the high standards set by its Editors' Choice award-winning predecessors, the ThinkPad 755C and the ThinkPad 750C. This $7,599 DX4/100-based portable is a fully equipped mobile office in an 8-pound-8-ounce package (including both floppy disk and CD-ROM drives).

The ThinkPad fits a double-speed CD-ROM drive into a space under the keyboard (that space can hold the unit's floppy disk drive instead). This CD-ROM drive is front-loadable, so no keyboard-flipping is required to change CDs.

The ThinkPad's 10.5-inch

SUMMARY OF FEATURES

CONTINUES

PC MAGAZINE

Products listed in alphabetical order ■ = YES □ = NO	CTX EzBook DX4/100	CTX EzNote 486DX/33	Dell Latitude 450C	Dell Latitude 450CX	Dell Latitude XP 450C	Dell Latitude XP 4100CX	DTK DTN-4T100P	Duracom 5110
List price (tested configuration)	$3,999	$1,699	$2,728	$3,428	$3,199	$5,099	$2,880 (est.)	$4,599
Processor type and speed	Intel DX4/100	Cyrix Cx486DX/33	Intel 486DX2/50	Intel 486DX2/50	Intel 486DX2/50	Intel DX4/100	Intel DX4/100	Intel DX4/100
Dimensions (HWD, in inches)	2 x 11.1 x 8.5	1.7 x 9.9 x 7.6	2 x 10.5 x 8.5	2 x 10.5 x 8.5	2.1 x 11 x 8.8	2.1 x 11 x 8.8	2.5 x 11 x 9.3	2 x 8.6 x 11
System weight, travel weight	6 lbs. 3 oz., 7 lbs. 7 oz.	4 lbs. 3 oz., 6 lbs. 9 oz. ❶	5 lbs. 14 oz., 6 lbs. 11 oz.	6 lbs. 3 oz., 6 lbs. 15 oz.	5 lbs. 14 oz., 6 lbs. 13 oz.	6 lbs. 1 oz., 7 lbs.	6 lbs. 14 oz., 8 lbs. 1 oz.	7 lbs. 5 oz., 8 lbs. 10 oz.
Display area and diagonal (inches)	5.7 x 7.1, 9.5	4.6 x 6.1, 7.8	5.5 x 7.5, 9.5	5.5 x 7.5, 9.5	5.7 x 7.6, 9.5	5.8 x 7.6, 9.4	6 x 8.3, 10.3	5.8 x 7.5, 9.5
Key size, distance between keys (millimeters)	12, 6	12, 7	12, 6	12, 6	13, 6	13, 6	12, 6	13, 5
Type of pointing device installed	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball
DOS, Windows version included	DOS 6.22, Windows 3.1	DOS 6.22, Windows 3.11	DOS 6.2, WfWG 3.11	DOS 6.2, WfWG 3.11	DOS 6.2, WfWG 3.11	DOS 6.2, WfWG 3.11	DOS 6.21, Windows 3.11	DOS 6.22, WfWG 3.11
Warranty on parts/labor	3 years/3 years	1 year/1 year	1 year/1 year	1 year/1 year	3 years/1 year	3 years/1 year	1 year/1 year	1 year/1 year
On-site service	None	None	$149.00 (1 year)	$149.00 (1 year)	Included (1 year)	Included (1 year)	None	Included (1 year)
Components								
Motherboard manufacturer	Veridata	Veridata	Dell	Dell	Dell	Dell	ACC	Kapok
Chip set manufacturer	WD	WD	OPTi	OPTi	WD	WD	ACC	SiS
BIOS version (or date)	AMI (8/17/94)	AMI (5/09/94)	Phoenix (8/19/94)	Phoenix (8/19/94)	Phoenix/Dell (9/07/94)	Phoenix/Dell (9/07/94)	AMI (8/06/92)	Award (9/06/94)
Flash BIOS/16550 UART support	■■	■■	■■	■■	■■	■■	□□	■□
Installed/maximum system RAM	8MB, 32MB	8MB, 32MB	8MB, 20MB	8MB, 20MB	8MB, 36MB	8MB, 36MB	8MB, 36MB	8MB, 36MB
Installed/maximum external cache	N/A	N/A	N/A	N/A	N/A	N/A	N/A	128K, 128K
Installed/maximum hard disk size	512MB, 720MB	262MB, 340MB	341MB, 524MB	340MB, 524MB	341MB, 524MB	524MB, 524MB	343MB, 520MB	340MB, 540MB
Screen manufacturer	Hosiden	Citizen	Dell	Dell	Dell	Dell	Sanyo	NEC
Screen type	Active color	Dual-scan color	Dual-scan color	Active color	Dual-scan color	Active color	Dual-scan color	Active color
Graphics chip set manufacturer	WD	WD	WD	WD	WD	WD	Cirrus Logic	Cirrus Logic
Graphics RAM and type	1MB DRAM	1MB DRAM	1MB VRAM	1MB VRAM	1MB VRAM	1MB VRAM	1MB VRAM	1MB DRAM
Simultaneous external display	■	■	■	■	■	■	■	■
PCMCIA slots	One Type II and one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III
Modem type installed	None	None	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	2,400-/9,600-bps PCMCIA data/fax
Power								
Rated charge time while on, off (hours:minutes)	3:00, 2:00	3:00, 2:00	2:30, 2:30	2:30, 2:30	2:30, 2:30	2:30, 2:30	3:30, 2:00	8:00, 2:00
Display/hard disk power-down	■■	■■	■■	■■	■■	■■	■■	■■
CPU/peripheral power-down	■■	■■	■■	■■	■■	■■	■□	□□
Standby/hibernation mode	■■	■■	■■	■■	■■	■■	□□	□□

N/A—Not applicable. The product does not have this feature. ❶ The travel weight includes the weight of the external floppy disk drive.
ACC—ACC Micro Electronics Inc., AMS—American Multisystems, BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DTI—Display Technologies Inc., FIC—First International Computer Inc., HP—Hewlett-Packard Co., NTC—Nan Tan Computer Co., SiS—Silicon Integrated Systems Corp., TI—Texas Instruments Inc., Veridata—Veridata Electronics Inc., WD—Western Digital Corp., ZDS—Zenith Data Systems

active-matrix display uses a technology developed by IBM called Black Matrix on Array. Black matrix displays still under development by other vendors coat the back of the TFT panel with a single layer of an antiglare substance. In IBM's Black Matrix on Array panels, each *transistor* is treated with an antiglare substance. This technology minimizes reflections caused by bright lighting and produces a crisp picture. The ThinkPad supports Super VGA external display, has video I/O jacks for a video camera or television, and has two slots that access an IrDA-compliant infrared ports.

Some of the ThinkPad's most intrigu-

IBM ThinkPad 755CD

	Windows applications	DOS applications	Road warrior	Desktop replacement
IBM ThinkPad	GOOD	GOOD	GOOD	EXCELLENT

chip: IBM's Mwave MDSP2780 digital signal-processing chip. It enables the system's built-in 14.4-Kbps fax modem (software-upgradable to 28.8 Kbps), SoundBlaster–compatible 16-bit audio, and telephony capabilities including its full-duplex speakerphone function.

The ThinkPad, equipped with 8MB of RAM and a 540MB hard disk, was an average performer in its class on our tests, except for below-average Disk Win-

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CIRCLE 044 ON READER SERVICE CARD

scores. On our WinDrain test, this unit lasted an impressive 2 hours 34 minutes.—*Carol Venezia*

▶ **IBM ThinkPad 755CD.** IBM Personal Computer Co., *Somers, NY; 800-772-2227, 914-766-1900.*

Circle 464 on reader service card

MidWest Micro

• MidWest Micro Elite Pentium SoundBook Plus

The Elite Pentium SoundBook Plus from MidWest Micro is one of two 90-MHz Pentium notebooks we tested. This system, priced at $5,599, is made up of many quality components—including a 10.4-inch active-matrix color display—and even utilizes a PCI expansion bus. But although this machine is competitively priced and equipped, it produced mixed results on our benchmark tests.

The SoundBook Plus, using 256K of write-through L2 cache and 16MB of RAM, produced the highest Winstone 95 score (183) of all reviewed systems. On the remainder of our tests, however, the system faltered: It was unable to complete our Disk WinMark 95 and Graphics WinMark 95 tests because its drivers are new and conflicted with Windows. The unit's other test scores were average, except for its DOS Disk score, which was well below average. The SoundBook Plus used a 677MB Enhanced IDE hard disk.

MidWest Micro Elite Pentium SoundBook Plus

	Windows applications	DOS applications	Road warrior	Desktop replacement
MidWest Micro SoundBook Plus	GOOD	GOOD	GOOD	GOOD

The system was loaded with some nice extras, including 16-bit stereo sound and dual stereo speakers; the speakers are integrated into the unit's wrist-rest area, on either side of the actuation buttons for the system's pointing stick. Other features include an infrared port (IRDA-compatible) and two Type II PCMCIA slots (or one Type III slot). The SoundBook Plus's active-matrix display is supported by Chips & Technologies' CT65545 chip set.

The SoundBook Plus weighs just under 8 pounds. Its nickel hydride battery was good for 1 hour 44 minutes on our WinDrain test.—*CV*

▶ **MidWest Micro Elite Pentium SoundBook Plus.** MidWest Micro, *Fletcher, OH; 800-728-8582, 513-368-2309; fax, 800-562-6622.*

Circle 466 on reader service card

Mintronix Inc.

• Mintronix SLic4100

If you decide that you can live with a small pop-out trackball that's almost unusable, you'll find the $2,745 Mintronix SLic4100 to be an otherwise well-built, low-cost system that's a strong performer under Windows.

The DX4/100-powered SLic4100 has most of the standard features of high-end notebooks such as a removable hard disk and two Type II PCMCIA slots. It also has an internal 14.4-Kbps fax modem, which is a nice plus. The 8-pound-1-ounce SLic4100 has a dual-scan passive-matrix color display that measures 9.5 inches diagonally. The unit came with 8MB of RAM but its system memory can be upgraded to a maximum of 52MB. These upgrades are relatively simple, but to gain access to the memory sockets, you must remove the internal modem. The process is not, however, documented anywhere in the manuals. Like the trackball on the Gateway's ColorBooks, the one on the SLic4100 pops out like a drawer from under the keyboard. Some people may find this trackball difficult to use.

The Slic4100's installed Toshiba 340MB hard disk helped boost its Disk WinMark 95 score well above the average of this processor class. Mintronix used a Chips & Technologies graphics accelerator chip set in the SLic4100's video subsystem; the unit only managed a below average Graphics WinMark 95 score, though. The system's Winstone 95 score was average, as were most of its DOS-based test scores, except for its DOS Video score, which was below average.—*WPF*

▶ **Mintronix SLic4100.** Mintronix Inc., *Camarillo, CA; 800-843-1239, 805-482-1298; fax, 805-987-8088.*

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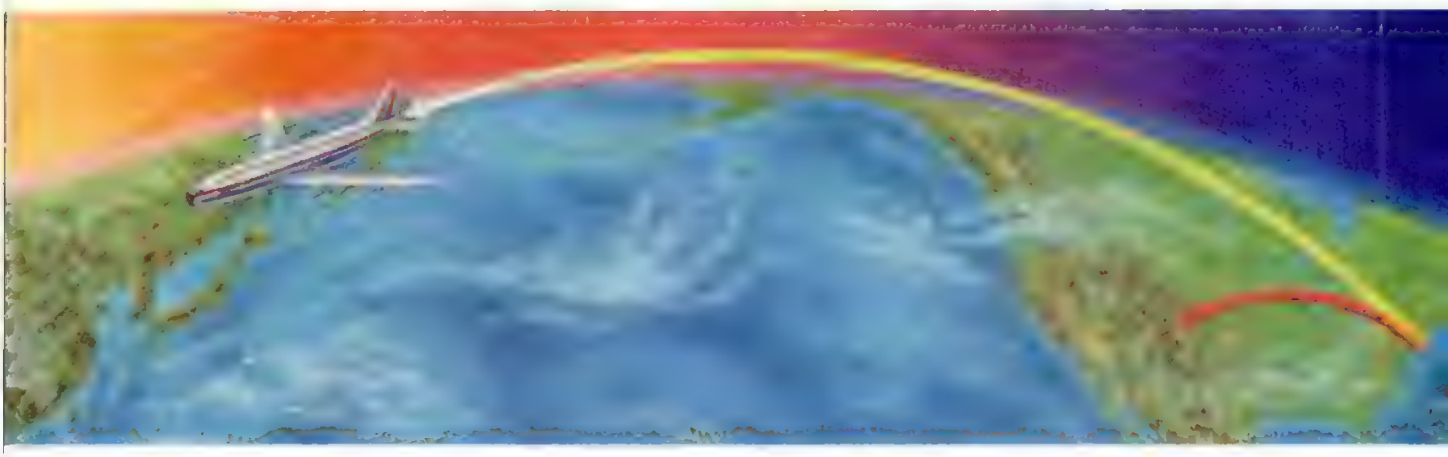

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CIRCLE 061 ON READER SERVICE CARD

SUMMARY OF FEATURES

CONTINUES

Products listed in alphabetical order ■ = YES □ = NO	Ergo PowerBrick 100	Ergo SubBrick 33	Everex Step Note DX2/50	FutureTech FutureMate FM386T	FutureTech FutureMate FM918T	Gateway ColorBook DX2-50	Gateway ColorBook DX4-75	Hertz Z-Optima 486 Notebook PC
List price (tested configuration)	$4,695	$2,495	$2,500	$4,583	$3,999	$3,199	$3,499	$3,184
Processor type and speed	Intel DX4/100	Cyrix Cx486DX/33	Intel 486DX2/50	Pentium/66	Intel DX4/100	Intel 486DX2/50	Intel DX4/75	Intel 486DX2/66
Dimensions (HWD, in inches)	2.3 x 11 x 8.3	1.9 x 9.8 x 7.5	2 x 11.3 x 8.8	2.5 x 11 x 10.3	2.3 x 11 x 8.3	2 x 11.7 x 8.5	2 x 11.7 x 8.5	2 x 11.5 x 8.9
System weight, travel weight	6 lbs. 15 oz., 8 lbs. 2 oz.	5 lbs. 7 oz., 6 lbs. 8 oz.❶	6 lbs. 2 oz., 7 lbs. 5 oz.	8 lbs. 14 oz., 10 lbs. 1 oz.	7 lbs. 4 oz., 8 lbs. 7 oz.	5 lbs. 14 oz., 7 lbs. 1 oz.	5 lbs. 14 oz., 7 lbs. 1 oz.	6 lbs. 12 oz., 8 lbs. 1 oz.
Display area and diagonal (inches)	5.8 x 7.5, 9.5	4.7 x 6.2, 7.8	5.7 x 7.6, 9.5	5.7 x 7.5, 9.5	5.8 x 7.5, 9.3	6.1 x 8.3, 10.3	6.1 x 8.3, 10.3	5.7 x 7.5, 9.5
Key size, distance between keys (millimeters)	12, 7	12, 6	13, 6	13, 6	13, 5	13, 6	13, 6	12, 7
Type of pointing device installed	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball
DOS, Windows version included	DOS 6.22, Windows 3.1	DOS 6.22, Windows 3.11	DOS 6.22, Windows 3.11	DOS 6.22, Windows 3.1	DOS 6.22, Windows 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, Windows 3.11
Warranty on parts/labor	4 years/4 years	4 years/4 years	2 years/2 years	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3 years/3 years
On-site service	Included (1 year)	Included (1 year)	Included (1 year)	None	None	None	None	$495.00 (1 year)
Components								
Motherboard manufacturer	Arima	Vendata	FIC	NTC	Kapok	Gateway	Gateway	Hertz
Chip set manufacturer	ACC	WD	Pico Power	OPTI	SIS	Pico Power	Pico Power	OPTI
BIOS version (or date)	Phoenix (11/11/92)	AMI (11/11/92)	Phoenix (4/19/94)	AMI (6/06/92)	Award (9/06/94)	SystemSoft (9/01/94)	SystemSoft (9/01/94)	AMI (6/06/92)
Flash BIOS/16550 UART support	■■	□□	■■	■■	■■	■■	■■	■■
Installed/maximum system RAM	8MB, 32MB	8MB, 20MB	8MB, 20MB	16MB, 40MB	16MB, 36MB	8MB, 20MB	8MB, 20MB	16MB, 16MB
Installed/maximum external cache	N/A	N/A	N/A	N/A	128K, 128K	N/A	N/A	N/A
Installed/maximum hard disk size	515MB, 720MB	261MB, 261MB	340MB, 524MB	528MB, 800MB	343MB, 800MB	250MB, 340MB	250MB, 340MB	341MB, 525MB
Screen manufacturer	NEC	Sony	Hitachi	Toshiba	Toshiba	Sanyo	Sanyo	Sharp
Screen type	Active color	Dual-scan color	Dual-scan color	Active color	Active color	Dual-scan color	Dual-scan color	Dual-scan color
Graphics chip set manufacturer	WD	WD	WD	Cirrus Logic	Cirrus Logic	Cirrus Logic	Cirrus Logic	Cirrus Logic
Graphics RAM and type	1MB DRAM	1MB DRAM	1MB DRAM	1MB VRAM	1MB VRAM	512K DRAM	512K DRAM	1MB DRAM
Simultaneous external display	■	■	■	■	■	■	■	■
PCMCIA slots	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	One Type II and one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III
Modem type installed	14,400-bps PCMCIA fax	2,400-/9,600-bps PCMCIA data/fax	14,400-bps PCMCIA fax	None	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax
Power								
Rated charge time while on, off (hours:minutes)	3:45, 2:00	5:00, 3:30	3:00, 1:30	4:00, 2:00	4:00, 2:00	N/A, 2:00	N/A, 2:00	4:00, 1:00
Display/hard disk power-down	■■	■■	■■	■■	■■	■■	■■	■■
CPU/peripheral power-down	■■	■■	■□	□□	□□	■■	■■	■■
Standby/hibernation mode	■■	■■	■■	□□	□□	■■	■■	■■

N/A—Not applicable. The product does not have this feature. ❶ The travel weight includes the weight of the external floppy disk drive.
ACC—ACC Micro Electronics Inc., AMS—American Multisystems, BSI—Brooktree Systems Inc., C&T—Chips & Technologies Inc., DTI—Display Technologies Inc., FIC—First International Computer Inc., HP—Hewlett-Packard Co., NTC—Nan Tan Computer Co., SIS—Silicon Integrated Systems Corp., TI—Texas Instruments Inc., Vendata—Vendata Electronics Inc., WD—Western Digital Corp., ZDS—Zenith Data Systems

Mintronix SLic4100

	Windows applications	DOS applications	Road warrior	Desktop replacement
Mintronix SLic4100	GOOD	GOOD	GOOD	GOOD

Mitsuba Corp.

- **Mitsuba Ninja-Lite**

The Ninja-Lite from Mitsuba is aggressively priced at $2,195 considering what it offers: It's based on the Intel 486DX2/66 processor and delivers every bit of the performance you would expect from that CPU. Moreover, it has a relatively light travel weight for a full-size notebook of 6 pounds 1 ounce. This weight includes the AC adapter, which is important because the system's battery life of 1 hour 31 minutes on our WinDrain test means you won't be able to travel very far without your adapter.

The Ninja-Lite has a dual-scan, passive-matrix color display that was crisp and bright. The integrated trackball is strategically placed below the keyboard and is comfortable to use. You can remove the hard disk with the help of a screwdriver. Furthermore, memory upgrades are easy. Our unit came with 8MB of RAM but maximum system RAM is 20MB; Mitsuba offers a 16MB module for $950. (If you already have 8MB on your system, the net cost is $795, since Mitsuba will buy back your 4MB memory module.) A 340MB hard disk was installed and the upgrade to 520MB (the

Mitsuba Ninja-Lite

	Windows applications	DOS applications	Road warrior	Desktop replacement
Mitsuba Ninja-Lite	GOOD	GOOD	GOOD	FAIR

largest available) is only $195.

Graphics are handled by a Chips & Technologies chip set that permits an external display resolution of 1,024 by 768 pixels. The unit's single PCMCIA slot can handle either one Type II or one Type III card (only one at a time).

The Ninja-Lite gave strong performances throughout our benchmark tests. Its CPUmark$_{16}$ score was the best in its class and was competitive with many of the DX4/75 and DX4/100 systems. The unit's Disk WinMark 95 score was also the best of the group and a strong score—even compared with other CPU groups. The Graphics WinMark 95 and Winstone 95 scores were average.—*WPF*

▶ **Mitsuba Ninja-Lite.** Mitsuba Corp., *La Verne, CA; 800-648-7822, 909-392-2000; fax, 909-392-2021.*

Circle 469 on reader service card

MPC Technologies Inc.
• MPC CD-Book

The $3,158 MPC CD-Book starts off with competitive features (a DX4/75 CPU, 8MB of RAM, a 340MB Toshiba hard disk, and an 8-pound-7-ounce travel weight) and goes one step further: Under the keyboard is a built-in Philips double-speed CD-ROM drive.

Just press in a latch and lift up the keyboard; the CD-ROM player is to the right, and the motherboard to the left. This arrangement makes both the CD-ROM and motherboard components—like the CPU and memory—easily accessible. Unfortunately, it's just as easy for dust and grime to get at your system's innards—especially considering how many times you're likely to change disks. We would be more comfortable with another thin lid over the motherboard.

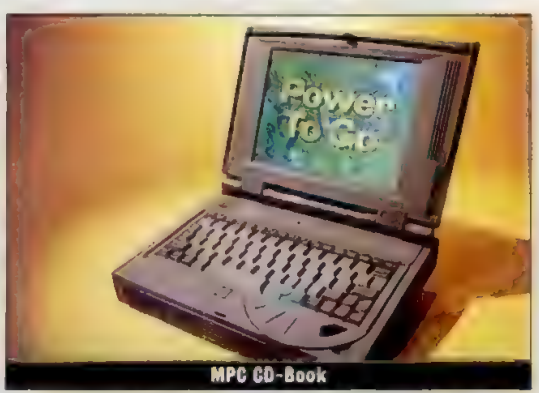
Still, its accessibility is a real plus—especially when compared with Panasonic's CD-ROM equipped notebook, which was occasionally hard to open. An even better solution is available in IBM's ThinkPad 755CD, which has an externally accessible CD-ROM drive very similar to a desktop system's.

The CD-Book had above-average scores on the DOS Disk and Disk WinMark 95 tests relative to other DX4/75-based machines. Its other test scores were average, except for a below-average score on the DOS Video tests. Its nickel hydride battery lasted about 1 hour 30 minutes on our WinDrain test.

The CD-Book comes with an easy-to-read 9.5-inch active-matrix screen. But the VersaPoint mouse, located between the space bar and the Alt key, was small and difficult to use. The hard disk is removable, and an external floppy disk drive is included. The unit also has two Type II PCMCIA slots that can act as one Type III slot. Touch screens and stylus-sensitive screens are now available for $150 each.—*MEB*

▶ **MPC CD-Book.** MPC Technologies Inc., *Santa Ana, CA; 800-672-8088, 714-724-9000; fax, 714-724-9648.*

Circle 470 on reader service card



MPC CD-Book

	Windows applications	DOS applications	Road warrior	Desktop replacement
MPC CD-Book	GOOD	GOOD	GOOD	GOOD

Panasonic Personal Computer Co.
• Panasonic V41

The $6,599 DX4/100-based Panasonic V41 is one of three systems reviewed to integrate a CD-ROM drive. Unlike the others, the V41 doesn't sacrifice a floppy disk drive to fit the CD-ROM into its case. But this design does have its tradeoffs: It's thicker and heavier than many reviewed units, with a travel weight of 9 pounds 5 ounces. The V41 offers average performance, highlighted by stunning graphics performance, but its time on our WinDrain test didn't quite reach the 1-hour mark.

Panasonic V41

	Windows applications	DOS applications	Road warrior	Desktop replacement
Panasonic V41	GOOD	GOOD	FAIR	GOOD

Beneath the flip-up keyboard is V41's CD-ROM drive; there's even a space next to it to store an extra CD. On the right side of the case is what Panasonic calls a "multimedia pocket." Our test system held the floppy disk drive, but the pocket can also fit a spare battery. The V41 has 16-bit stereo sound compatible with the Creative Labs SoundBlaster Pro.

The V41 has a brilliant 10.4-inch active-matrix color display. (A 10.4-inch dual-scan display is also available for $1,000 less.) This panel is protected by a durable magnesium casing, and the unit uses a nonadjustable, hardware-level display timeout,

SUMMARY OF FEATURES

CONTINUES

Products listed in alphabetical order ■ = YES □ = NO	HP OmniBook 600C PC	IBM ThinkPad 756CD	Micro Express NB9266	MidWest Micro Elite DX4-100 SoundBook	MidWest Micro Elite Pentium SoundBook Plus	Milkyway MyriadBook/486	Mintronix SLic4100	Mitsuba Ninja-Lite
List price (tested configuration)	$3,848 (est.)	$7,599	$2,399	$3,999	$5,599	$3,395	$2,745	$2,195
Processor type and speed	Intel DX4/75	Intel DX4/100	Intel 486DX2/66	Intel DX4/100	Pentium/90	Intel 486DX2/66	Intel DX4/100	Intel 486DX2/66
Dimensions (HWD, in inches)	1.8 x 11.1 x 7.3	2.2 x 11.7 x 8.3	2.1 x 11 x 8.7	1.9 x 11 x 8.5	2 x 11 x 8.5	2.3 x 11 x 8.8	2 x 11 x 8.5	1.9 x 10.5 x 8.3
System weight, travel weight	3 lbs. 15 oz., 5 lbs. 7 oz. ❶	6 lbs. 11 oz., 8 lbs. 8 oz. ❷	7 lbs., 9 lbs. 2 oz.	6 lbs. 11 oz., 7 lbs. 14 oz.	6 lbs. 11 oz., 7 lbs. 14 oz.	6 lbs. 15 oz., 8 lbs. 2 oz.	6 lbs. 13 oz., 8 lbs. 1 oz.	5 lbs. 1 oz., 6 lbs. 1 oz.
Display area and diagonal (inches)	5.3 x 6.8, 8.5	6.3 x 8.4, 10.5	6 x 8.3, 10.5	5.5 x 7.6, 9.5	6.3 x 8.4, 10.4	5.8 x 7.8, 9.5	5.5 x 7.8, 9.5	5.8 x 7.8, 9.5
Key size, distance between keys (millimeters)	13, 6	14, 5	13, 6	12, 7	12, 7	13, 6	12, 5	14, 4
Type of pointing device installed	Integrated mouse	Integrated pointing stick	Integrated trackball	Integrated trackball	Integrated pointing stick	Integrated trackball	Integrated trackball	Integrated trackball
DOS, Windows version included	DOS 6.2, WfWG 3.11	PC-DOS 6.3, Windows 3.1	DOS 6.22, Windows 3.11	DOS 6.22, Windows 3.11	DOS 6.22, WfWG 3.11	PC-DOS 6.3, Windows 3.11	DOS 6.21, WfWG 3.11	DOS 6.22, WfWG 3.11
Warranty on parts/labor	3 years/3 years	3 years/3 years	15 months/ 15 months	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year
On-site service	None	$40.00 (1 year)	None	None	None	$49.00 (1 year)	$85.00 (1 year)	None
Components								
Motherboard manufacturer	HP	IBM	Micro Express	Compal	Compal	[illegible]	Mintronix SLic	Mitsuba
Chip set manufacturer	C&T	Pico Power	SIS	Pico Power	VLSI	SIS	Pico Power	Pico Power
BIOS version (or date)	Phoenix (10/07/94)	IBM (9/22/94)	Award (9/06/94)	SystemSoft 1.05A	Phoenix 4.04	Award (9/06/94)	Phoenix (4/19/90)	SystemSoft (5/03/94)
Flash BIOS/16550 UART support	■■	■■	■■	■□	■■	■□	■□	■□
Installed/maximum system RAM	16MB, 16MB	8MB, 40MB	8MB, 36MB	12MB, 20MB	16MB, 40MB	8MB, 32MB	8MB, 52MB	8MB, 20MB
Installed/maximum external cache	N/A	N/A	128K, 128K	N/A	256K, 256K	N/A	N/A	N/A
Installed/maximum hard disk size	171MB, 260MB	540MB, 810MB	343MB, 520MB	525MB, 720MB	677MB, 720MB	343MB, 800MB	340MB, 540MB	340MB, 520MB
Screen manufacturer	Hitachi	DTI	NEC	Hitachi	Hitachi	Sanyo	Sharp	Sharp
Screen type	Dual-scan color	Active color	Dual-scan color	Active color	Active color	Active color	Dual-scan color	Dual-scan color
Graphics chip set manufacturer	C&T	WD	Cirrus Logic	C&T	C&T	Cirrus Logic	C&T	C&T
Graphics RAM and type	1MB DRAM	1MB DRAM	1MB VRAM	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM	512K DRAM
Simultaneous external display	■	■	■	■	■	■	■	■
PCMCIA slots	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II	One Type II or one Type III
Modem type installed	14,400-bps PCMCIA fax	14,400-bps internal fax	14,400-bps PCMCIA fax	None	None	14,400-bps PCMCIA fax	14,400-bps internal fax	14,400-bps PCMCIA fax
Power								
Rated charge time while on, off (hours:minutes)	4:00, 4:00	1:42, 1:12	N/A, 3:00	4:00, 2:00	4:00, 2:00	N/A, 2:30	2:15, 2:15	3:00, 2:00
Display/hard disk power-down	■■	■■	■■	■■	■■	■■	■■	■■
CPU/peripheral power-down	■■	■■	■□	■■	■■	□□	■■	■■
Standby/hibernation mode	■■	■■	■□	■■	□■	□□	■■	■■

N/A—Not applicable. The product does not have this feature. ❶ The travel weight includes the weight of the external floppy disk drive. ❷ The travel weight includes the weight of the removable floppy disk drives and CD-ROM drive.
ACC—ACC Micro Electronics Inc., AMS—American Multisystems, BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DTI—Display Technologies Inc., FIC—First International Computer Inc., HP—Hewlett-Packard Co., NTC—Nan Tan Computer Co., SIS—Silicon Integrated Systems Corp., TI—Texas Instruments Inc., Vendata—Vendata Electronics Inc., WD—Western Digital Corp., ZDS—Zenith Data Systems.

which blanks the screen after about 2 minutes of inactivity—a minor annoyance (if you pause in the middle of a presentation, for example) that took some getting used to. The V41 is capable of SVGA-level external display.

The V41 was an average performer on most of our benchmark tests with two exceptions. On our Graphics WinMark 95 tests, the V41—using a Chips & Technologies 65545 chip set—posted the highest score of all systems tested by a wide margin. Its only below-average score was on the Disk WinMark 95 tests.—*CAV*

▶ **Panasonic V41.** Panasonic Personal Computer Co., *Secaucus, NJ; 800-742-8086; fax, 201-392-6610.*

Circle 470 on reader service card

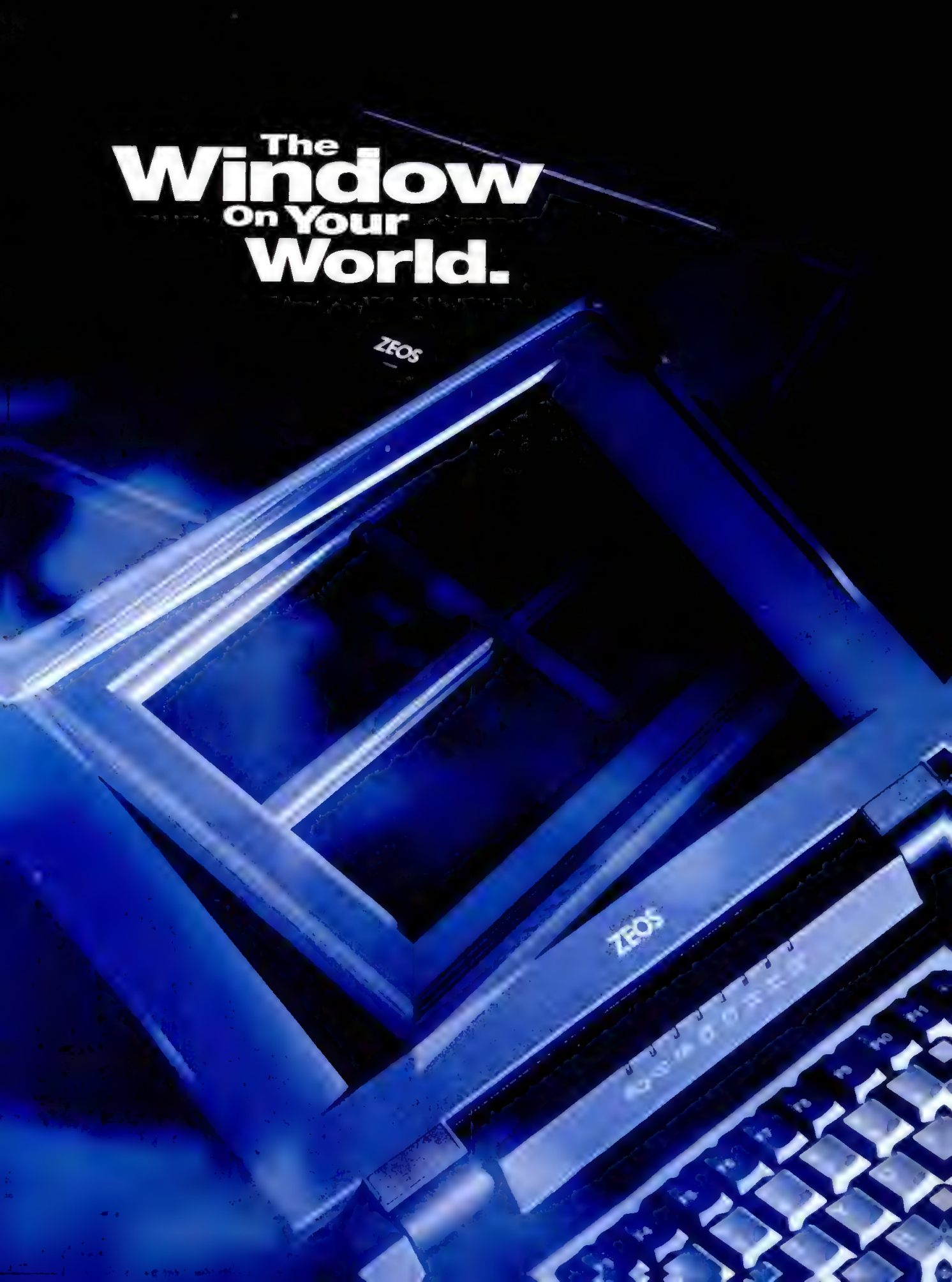
Texas Instruments

- **TI TravelMate 4000M/50 Dual Scan**
- **TI TravelMate 4000M DX4/75 Dual Scan**

Texas Instruments continues its long tradition of well-designed notebooks with this latest pair of TravelMate 4000Ms. The $4,799 TravelMate 4000M DX4/75 Dual Scan and the $3,399 TravelMate 4000M/50 Dual Scan offer all the amenities you'd expect to find in a full-featured notebook: built-in 16-bit sound capabilities, two Type II PCMCIA slots (us-

TI TravelMate 4000M DX4/75 Dual Scan

	Windows applications	DOS applications	Road warrior	Desktop replacement
TI 4000M/50	GOOD	FAIR	GOOD	FAIR
TI 4000M DX4/75	GOOD	GOOD	GOOD	FAIR


The Window On Your World.
ZEOS
ZEOS

The 400 is molded from a special carbon-fiber material that cuts weight and improves durability.

ZEOS Meridian notebooks include high-speed local bus video accelerated by a genuine Intel 486DX2-50 or DX4-100 microprocessor.

Choose from an active matrix color, passive matrix color or mono-chrome display. (Unretouched photo of active matrix display.)

Two Type II PCMCIA slots for fax/modem, network, SCSI and sound cards.

Comfort and convenience with an integrated TruePoint™ pointing device within the comfortable palm rest.

Meridian 400 and 800 notebooks feature an 84-key keyboard with embedded numeric keypad, 12 dedicated function keys and inverted "T" arrow keys.

The ZEOS Meridian™ Is Opening New Doors.

Access uncharted territories. Enter avenues never before explored. Travel from portal-to-portal, from door-to-door, from work-to-home—in absolute comfort and confidence. The ZEOS Meridian notebook line is the doorway to your portable computing needs.

What makes the ZEOS Meridian one step ahead of the rest? Slamming performance and power up to 100MHz; durable, sturdy construction that will withstand the rigors of travel; and more options and extras than Bill has windows.

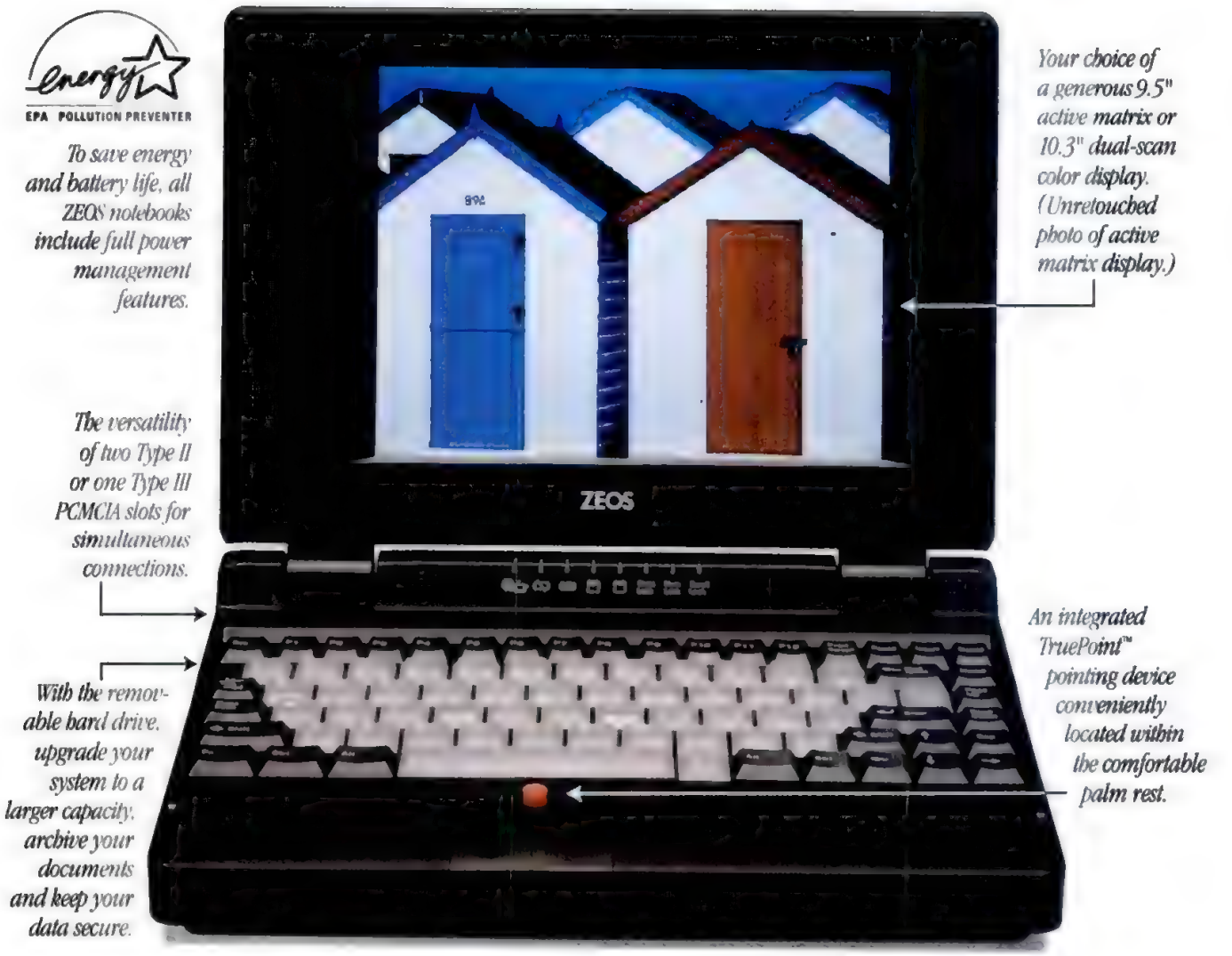
Meridian 400 Subnotebook

At just under four pounds, the ZEOS Meridian 400 sub-notebook offers you the perfect approach to traveling, working abroad, and second system computing. As *PC Magazine* said: "The ZEOS Meridian…pushes a subnotebook's abilities to new heights."

The 400 features three screen options: 7.9" diagonal active matrix, 7.9" diagonal passive matrix, or 8.2" monochrome. You also get two Type II PCMCIA slots and an external ultra-light 3.5" 1.44MB floppy drive (standard on Packages 2 and 3).

Meridian 800 Notebook

Desktop power to go! At 6.3 pounds, the ZEOS Meridian 800 is light enough to travel anywhere yet it's large enough to use



for presentations and regular desktop computing. You get the best of both worlds!

For your viewing pleasure, the 800 is available with your choice of color displays: a whopping 10.3" diagonal dual scan or 9.5" diagonal active matrix. The Meridian 800 also includes two Type II or one Type III PCMCIA slots, and an internal 3.5" 1.44MB floppy drive.

Buy With Confidence

No matter which ZEOS notebook you purchase, you can be assured you're getting the best service and support in the business! *PC World* said: "ZEOS's nonstop toll-free technical support schedule is unbeatable." *PC Magazine* agrees: ZEOS has won six *PC Magazine* Readers' Choice for Service & Reliability awards. No company has won more. In addition, ZEOS was the first to provide 24-hour toll-free technical support for quick and accurate answers to your questions.

Travel is easier. Work is easier. Therefore, your life will be easier. With its durable design, awesome performance and technologically-advanced features, you'll be able to keep in touch with the office, write memos, and organize your calendar—wherever you are. It'll open new doors and provide access to priority documents—24 hours a day. Be one step ahead of the rest with the ZEOS Meridian. Call your ZEOS Systems Consultant today.

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ZEOS Meridian™ Notebooks.

Package 1			Package 2			Package 3		
STN & DSTN	400C	800C	STN & DSTN	400C	800C	STN & DSTN	400C	800C
486DX2-50	$2095	$2395	486DX2-50	$2395	$2595	486DX2-50	$2695	$2895
DX4-100	$2395	$2695	DX4-100	$2695	$2895	DX4-100	$2995	$3195
Active Matrix	400A	800A	Active Matrix	400A	800A	Active Matrix	400A	800A
486DX2-50	$2795	$3195	486DX2-50	$3095	$3395	486DX2-50	$3395	$3695
DX4-100	$3095	$3495	DX4-100	$3395	$3695	DX4-100	$3695	$3995
➤ 4MB RAM ➤ 175MB IDE hard drive ➤ 800: Internal 3.5" 1.44MB floppy drive ➤ MS-DOS 6.2			➤ 4MB RAM ➤ 260MB IDE hard drive ➤ 3.5" 1.44MB floppy drive, 400: External, 800: Internal ➤ Custom carrying case ➤ MS-DOS 6.2 ➤ Microsoft Windows for Workgroups 3.11 ➤ Lotus Organizer			➤ 8MB RAM ➤ 350MB IDE hard drive ➤ 3.5" 1.44MB floppy drive, 400: External, 800: Internal ➤ Custom carrying case ➤ Extra battery ➤ MS-DOS 6.2 ➤ Microsoft Windows for Workgroups 3.11 ➤ Lotus Organizer		

Included With Every ZEOS Meridian:

intel inside

- ➤ Intel® 486DX2-50 or DX4-100 microprocessor.
- ➤ 8K (DX4: 16K) internal system cache.
- ➤ RAM expandable to 20MB.
- ➤ IDE hard drive upgradable to 350MB.
- ➤ PCMCIA slots. 400: 2 Type II, 800: 2 Type II or 1 Type III.
- ➤ Local bus video with 1MB video RAM.
- ➤ Display: 640 x 480 color VGA backlit LCD, up to 256 colors. 400: 7.9" diagonal STN or active matrix. 800: 10.3" diagonal DSTN or 9.5" diagonal active matrix.
- ➤ Supports an external SVGA color monitor at resolutions up to 1024 x 768.
- ➤ 84-key keyboard with embedded numeric keypad, 12 dedicated function keys and inverted "T" arrow keys.
- ➤ Integrated TruePoint™ pointing device.

- ➤ Replaceable, rechargeable NiMH battery.
- ➤ Serial port, enhanced parallel port, external VGA video port, external keyboard or PS/2 mouse port (800 includes both). 400 also with external floppy drive port.
- ➤ Full power management features include Low Power mode and programmable Standby features.
- ➤ AC-DC adapter with full range from AC110-240V to DC.
- ➤ 400: 7.8" x 10.2" x 1.7"; 3.9 lbs. 800: 8.9" x 11.7" x 1.9"; 6.3 lbs.
- ➤ EPA Energy Star compliant.
- ➤ FCC Certified Class B; UL Listed.
- ➤ ZEOS Customer Satisfaction Package.

Favorite Options

Screen Option
Monochrome VGA backlit LCD display, 8.2" diagonal (from Meridian 400C to 400) **-$300**

Hard Drive Upgrades
175MB to 260MB **$95**
260MB to 350MB **$145**

Memory Upgrades
4MB to 8MB **$199**
8MB to 20MB **$999**
4MB to 20MB **$1195**

PCMCIA Cards

Networking
PCMCIA Ethernet adapter
10 Base T (Twisted Pair) **$139**
10 Base 2 (Coax) **$169**

Modems
PCMCIA 24/96 data/fax modem with Internal DAA **$149**
PCMCIA 14.4/14.4 data/fax modem with Internal DAA **$199**

SCSI Adapter
PCMCIA SCSI II adapter with Corel SCSI 2.0 **$199**

Multimedia
PCMCIA 16-bit stereo sound card with Microsoft's Sound System 2.0 **$279**

Floppy Disk Drive
400: External 3.5" 1.44MB FDD (9 oz.) **$99**

Accessories
Custom nylon carrying case **$79**
Custom leather carrying case **$178**
SPECIAL PACKAGE PRICE: 14" SVGA color monitor, keyboard and mouse. (with notebook purchase) **$349**
400: Y-cable **$29**

Power
Extra battery **$99**
Extra AC adapter **$69**
DC-AC adapter **$59**
Telemax surge suppressor **$69**

Many other upgrades and options available. Call for details.

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CIRCLE 151 ON READER SERVICE CARD.

SUMMARY OF FEATURES

CONTINUES

■ = YES □ = NO

	MPC CD-Book	Panasonic V41	Samsung S3945T DX4/75	Summit Mount Hood	Summit Mount Rainier	TI TravelMate 4000M/50 Dual Scan	TI TravelMate 4000M DX4/75 Dual Scan	Toshiba Portégé T3600CT
List price (tested configuration)	$3,158	$6,599	$4,095	$2,350	$3,350	$3,399	$4,799	$4,099 (est.)
Processor type (and) speed	Intel DX4/75	Intel DX4/100	Intel DX4/75	Intel 486DX2/66	Intel DX4/100	Intel 486DX2/50	Intel DX4/75	Intel 486DX2/50
Dimensions (HWD in inches)	2.5 x 11.5 x 8.8	2.3 x 11.7 x 9.4	2.3 x 11.3 x 8.9	2.5 x 8.5 x 10.5	2.3 x 11 x 9.3	2 x 10.9 x 8.6	2 x 11 x 8.5	1.9 x 9.9 x 8
System weight, travel weight	6 lbs. 11 oz., 8 lbs. 7 oz. ❶	8 lbs. 1 oz., 9 lbs. 5 oz.	6 lbs. 7 oz., 7 lbs. 6 oz.	6 lbs. 15 oz., 8 lbs. 3 oz.	7 lbs. 4 oz., 8 lbs. 8 oz.	6 lbs. 7 oz., 7 lbs.	6 lbs. 5 oz., 6 lbs. 14 oz.	4 lbs. 8 oz., 5 lbs. 15 oz. ❶
Display area and diagonal (inches)	5.8 x 7.1, 9.5	6.5 x 8.4, 10.4	5.8 x 7.6, 9.5	6 x 8.3, 10	5.7 x 7.5, 9.5	5.8 x 7.5, 9.5	5.8 x 7.5, 9.5	5.3 x 6.8, 8.5
Key size: distance between keys (millimeters)	13, 6	13, 6	13, 6	12, 6	12, 6	13, 6	12, 6	12, 5
Type of pointing device installed	Integrated pointing stick	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated pointing stick	Integrated pointing stick	Integrated pointing stick
DOS, Windows version included	DOS 6.22, WfWG 3.11	DOS 6.2, Windows 3.1	DOS 6.21, Windows 3.1	DOS 6.22, Windows 3.11	DOS 6.22, Windows 3.11	DOS 6.2, WfWG 3.11	DOS 6.2, WfWG 3.11	DOS 6.21, WfWG 3.11
Warranty on parts/labor	1 year/1 year	1 year/1 year	2 years/2 years	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3 years/3 years
On-site service	None	None	None	$50.00 (1 year)	$50.00 (1 year)	$129.00 (1 year)	$129.00 (1 year)	$49.95 (3 years)
Components								
Motherboard manufacturer	MPC	Matsushita	Samsung	Chem	NEC	TI	TI	Toshiba
Chip set manufacturer	OPTi	Pico Power	Pico Power	ACC	ACC	TI	TI	Toshiba
BIOS version (or date)	AMI (10/05/94)	IBM 1.0L17	Phoenix (6/10/94)	AMI (6/06/92)	AMI (6/06/92)	Phoenix (3/22/94)	Phoenix (3/22/94)	Toshiba 0.71
Flash BIOS/16550 UART support	■■	■■	■■	□□	□□	■■	□■	■■
Installed/maximum system RAM	8MB, 64MB	8MB, 32MB	8MB, 20MB	8MB, 36MB	8MB, 36MB	8MB, 20MB	8MB, 20MB	8MB, 24MB
Installed/maximum external cache	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Installed, maximum hard disk size	340MB, 700MB	455MB, 680MB	213MB, 500MB	344MB, 540MB	343MB, 540MB	340MB, 340MB	455MB, 455MB	261MB, 261MB
Screen manufacturer	Hitachi	Matsushita	Samsung	Sanyo	Sanyo	Sanyo	Sanyo	Toshiba
Screen type	Active color	Active color	Active color	Active color	Dual-scan color	Dual-scan color	Dual-scan color	Active color
Graphics chip set manufacturer	C&T	C&T	WD	Cirrus Logic	Cirrus Logic	Cirrus Logic	Cirrus Logic	WD
Graphics RAM and type	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM
Simultaneous external display	■	■	■	■	■	■	■	■
PCMCIA slots	Two Type II or one Type III	Two Type II or one Type III	One Type II and one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	One Type II
Modem type installed	None	None	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	None
Power								
Rated charge time while on, off (hours:minutes)	6:00, 3:00	5:24, 3:36	2:30, 2:00	2:00, 2:00	2:00, 2:00	3:00, 3:00	3:00, 3:00	9:00, 3:00
Display/hard disk power-down	■■	■■	■■	■■	■■	■■	■■	■■
CPU/peripheral power-down	■■	■□	■■	□□	■□	■■	■■	■□
Standby/hibernation mode	■■	■■	■■	■□	■■	□□	□□	■□

N/A—Not applicable. The product does not have this feature. ❶ The travel weight includes the weight of the external floppy disk drive.
ACC—ACC Microelectronics Corp. AMI—American Megatrends Inc. Chem—Chem Tech Computer Co. Ltd. Compaq—Compaq Computer Corp. Elnadata—Elnadata Systems Inc. C&T—Chips & Technologies Inc. OTI—Oppsy Technologies Inc. FIC—First International Computer Inc.
HP—Hewlett-Packard Co. NTC—Nan Tan Computer Co. SIS—Silicon Integrated Systems Corp. TI—Texas Instruments Inc. Vendata—Vendata Electronics Inc. WD—Western Digital Corp. ZDS—Zenith Data Systems.

able as one Type III slot), an integrated pointing stick below the keyboard, and one of the lightest and smallest adapters we've seen. These features are also backed by top-notch performance.

The two systems weigh about 7 pounds (travel weight) and come in identical cases. Both have crisp and bright 9.5-inch dual-scan passive-matrix color screens (an active-matrix display is available for an additional $800 to $1,000) and comfortable keyboards. A minor problem is the size of the directional keys which, though well positioned, are a little less than half the normal key size. Both were equipped with 8MB of memory (expandable to 20MB). The 4000M DX4/75 had a Seagate 455MB hard disk (the largest available at this time), while the 486DX2/50-based 4000M/50 used a 340MB Seagate hard disk. For further expansion, Texas Instruments offers its $899 portable CD-ROM Docking System with these units, which includes a double-speed CD-ROM drive, built-in SCSI-2 support, and built-in speakers.

The systems' nickel hydride batteries served them well. The 4000M DX4/75 managed an impressive 2 hours 40 minutes on our WinDrain test, while its sibling lasted 3 hours 8 minutes (the best performance of all tested units with nickel hydride batteries).

The TravelMates continued to perform impressively on our benchmark tests. Both had above-average scores on the majority of our tests, compared with systems of their respective CPU groups, and average Winstone 95 and Graphics WinMark 95 results. Both had above-average scores on the Disk WinMark 95 tests.

Texas Instruments also markets its TravelMate 4000E series (not reviewed here), which emphasizes desktop replacement and a more all-purpose docking station. The company will soon launch its 5000M series, which will feature a Pentium/75 CPU, PCI bus technology, larger displays, and greater multimedia capabilities.—*AY*

▶ TI TravelMate 4000M/50 Dual Scan, TI TravelMate 4000M DX4/75 Dual

Scan. Texas Instruments, *Austin, TX; 800-848-3927, 512-794-5970; fax, 512-250-7329.*

Circle 474 on reader service card

Toshiba America Information Systems

EDITORS' CHOICE • Toshiba Portégé T3600CT

If you want great battery life in a rugged little machine, Toshiba's $4,099 (suggested retail price) Portégé T3600CT has few peers. A recent winner of *PC Magazine*'s Award for Technical Excellence, this 5-pound-15-ounce (travel weight) subnotebook has an 8.5-inch active-matrix color display and measures less than 8 by 10 inches. On our WinDrain battery test, the Portégé lasted longer (3 hours 58 minutes) than any other machine in this roundup; in actual use, we've found it lasts almost as long as a nonstop transcontinental flight. Toshiba also offers a line of full-size notebooks; the flagship T4850CT is reviewed separately.

There's one compromise: The keyboard has 17-mm keys and is 10 percent smaller than standard notebook keyboards. You can adapt to the smaller size, but may never be completely comfortable. The AccuPoint pointing stick looks like IBM's TrackPoint, but IBM's feels a hair more responsive. The keyboard is at the back of the unit; there's a 3-inch palm rest with a rounded front edge housing the AccuPoint selection buttons.

Toshiba Portégé T3600CT

	Windows applications	DOS applications	Road warrior	Desktop replacement
Toshiba Portégé	FAIR	FAIR	EXCELLENT	FAIR

A 486DX2/50 CPU drives the Portégé; 8MB of RAM, expandable to 24MB, is standard. There's one hard disk size: 261MB. The basic design of the system dates to the end of 1993 and the 486SX/33-based Portégé T3400CT; the T3400CT is still available.

The Portégé's performance was adequate for its CPU class. Its Winstone 95 and Disk WinMark 95 scores were above average, but its Graphics WinMark 95 performance was subpar despite its local bus graphics subsystem.

The Portégé includes full-size serial and parallel ports, one Type II PCMCIA slot, and a connector for a $239 port replicator. To use an external monitor, you need a small adapter plug or the port replicator. Because of its small size and travel weight (just 5 pounds 4 ounces without the external floppy disk drive), this is the perfect system for frequent travelers who value superior portability—especially if they have small fingers.—*Bill Howard*

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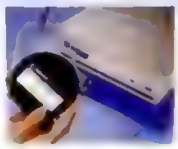
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CIRCLE 175 ON READER SERVICE CARD

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Joplin, MO– Data Traveler Portable Hard Disk

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San Bernardino, CA– Kingston Memory Upgrades

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PC MAGAZINE CIRCLE 106 ON READER SERVICE CARD

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▶ **Toshiba Portégé T3600CT.** Toshiba America Information Systems, *Irvine, CA, 800-334-3445, 714-583-3000.*

Circle 475 on reader service card

Toshiba America Information Systems
- **Toshiba T4850CT**

Toshiba's high-end notebook line has consistently improved in processor speed and display technology over the years, while the basic system design has remained much the same. Toshiba's $6,099 (suggested retail price) T4850CT still offers the high performance expected from this end of Toshiba's notebook spectrum but doesn't offer all the amenities of some of today's standard-setting systems. Toshiba has recently launched the Pentium/75-based T4900 (not reviewed here).

The T4850CT is the only notebook in this roundup that lacks an integrated pointing device. But with each new revision of the line, Toshiba adds some improvements, such as a previous addition of two PCMCIA slots that can accommodate two Type II cards or one Type III device. Like the T4800CT, the T4850CT

	Windows applications	DOS applications	Road warrior	Desktop replacement
Toshiba T4850CT	GOOD	GOOD	GOOD	FAIR

continues to bring sound into the mix with built-in 16-bit sound capability, as well as an integrated microphone and speakers. There are also ports for external speakers and an external microphone. The T4850CT's differentiator is its new 10.4-inch active-matrix screen.

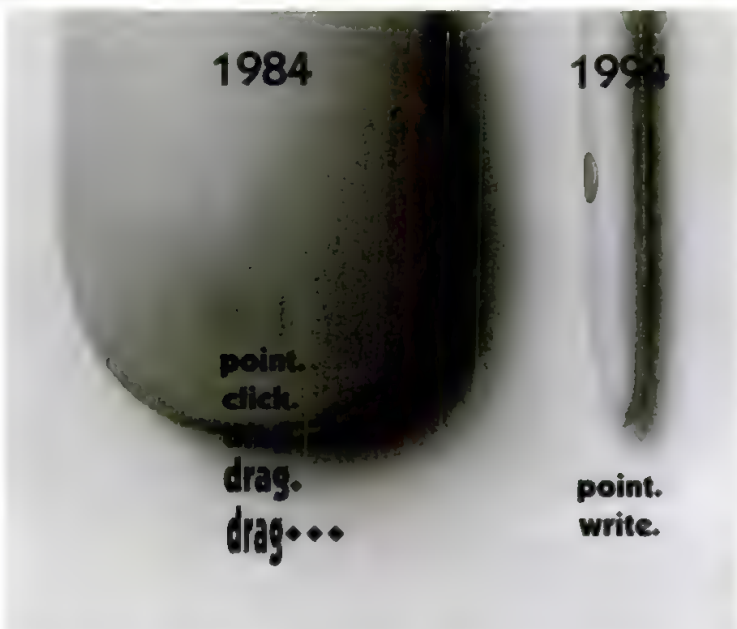
The T4850CT's battery life was a respectable 2 hours 21 minutes. Our benchmark tests show that the T4850CT is also an above-average Windows performer. Its Winstone 95 score was above average compared with other DX4/75-based systems we tested for this review. Its Graphics WinMark 95 score, boosted by the unit's Western Digital Rocket chip set, was average. The system's 528MB hard disk helped the T4850CT post the best Disk WinMark 95 score of its processor group.—*WPF*

▶ **Toshiba T4850CT.** Toshiba America Information Systems, *Irvine, CA; 800-334-3445, 714-583-3000.*

Circle 475 on reader service card

Twinhead Corp.
- **Twinhead Slimnote 550S**
- **Twinhead Slimnote 550T**
- **Twinhead Slimnote 510T**

The Slimnote line from Twinhead combines a solid design with strong performance and features such as integrated sound capabilities not available in most



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CIRCLE 329 ON READER SERVICE CARD

SUMMARY OF FEATURES

CONTINUES

Products listed in alphabetical order ■ = YES □ = NO	Toshiba T4850CT	Tri-Star MediaBook	Twinhead Slimnote 550S	Twinhead Slimnote 550T	Twinhead Slimnote 5100T	WinBook XP 486DX4/100 8/520 Active-Matrix	WinBook XP 486DX4/100 8/520 Dual-Scan Color	ZDS Z-Lite
List price (tested configuration)	$8,099 (est.)	$3,995	$3,299	$3,799	$4,899	$4,108	$3,059	$2,128
Processor type and speed	Intel DX4/75	Intel DX4/100	Intel 486DX2/50	Intel 486DX2/50	Intel DX4/100	Intel DX4/100	Intel DX4/100	Cyrix Cx486DLC-33
Dimensions (HWD, in inches)	2.3 x 11.8 x 8.3	2.3 x 11 x 8.5	2 x 11.6 x 8.9	2 x 11.6 x 8.9	2 x 11.6 x 8.9	2 x 11.4 x 8.9	2 x 11.4 x 8.9	2 x 7.3 x 9.8
System weight, travel weight	7 lbs., 7 lbs. 15 oz.	7 lbs. 5 oz., 8 lbs. 8 oz.	6 lbs. 4 oz., 7 lbs. 11 oz.	6 lbs. 4 oz., 7 lbs. 3 oz.	6 lbs. 4 oz., 7 lbs. 3 oz.	6 lbs. 7 oz., 7 lbs. 3 oz.	6 lbs. 5 oz., 7 lbs. 2 oz.	4 lbs. 2 oz., 5 lbs. 13 oz. ❶
Display area and diagonal (inches)	6.2 x 8.3, 10.4	5.6 x 7.5, 9.5	5.5 x 7.8, 9.5	5.8 x 7.5, 9.5	5.8 x 7.5, 9.5	5.7 x 7.6, 9.4	6 x 8.3, 10.3	4.5 x 6.3, 7.8
Key size, distance between keys (millimeters)	12, 7	12, 6	14, 4	14, 4	14, 4	13, 6	13, 6	12, 4
Type of pointing device installed	Clip-on trackball	Integrated trackball	Integrated trackball	Integrated trackball	Integrated trackpad	Integrated pointing stick	Integrated pointing stick	Integrated J-key
DOS, Windows version included	DOS 6.21, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, Windows 3.1	DOS 6.22, Windows 3.1	DOS 6.22, Windows 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.2, WfWG 3.11
Warranty on parts/labor	3 years/3 years	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year
On-site service	$49.95 (3 years)	None	None	None	None	None	None	Included (1 year)
Components								
Motherboard manufacturer	Toshiba	DTI	Twinhead	Twinhead	Twinhead	ASE	ASE	ZDS
Chip set manufacturer	Toshiba	SIS	Pico Power	Pico Power	Pico Power	ACC	ACC	OPTi
BIOS version (or date)	Toshiba T4850CT 1.20	Award 4.5	Phoenix (8/18/94)	Phoenix A486 1.03	Phoenix 1.03	Phoenix (4/19/90)	Phoenix 1.33	Phoenix (4/19/90)
Flash BIOS/16550 UART support	■■	■□	■■	■■	■■	■■	■■	■■
Installed/maximum system RAM	8MB, 24MB	8MB, 32MB	8MB, 32MB	8MB, 32MB	16MB, 32MB	8MB, 32MB	8MB, 32MB	8MB, 12MB
Installed/maximum external cache	N/A	128K, 128K	N/A	N/A	N/A	N/A	N/A	N/A
Installed/maximum hard disk size	520MB, 772MB	339MB, 528MB	340MB, 520MB	340MB, 520MB	520MB, 520MB	513MB, 520MB	505MB, 520MB	209MB, 340MB
Screen manufacturer	Toshiba	Sharp	Sharp	Sharp	Sharp	Hitachi	Sanyo	Sanyo
Screen type	Active color	Active color	Dual-scan color	Active color	Active color	Active color	Dual-scan color	Passive color
Graphics chip set manufacturer	WD	Cirrus Logic	WD	WD	WD	WD	WD	C&T
Graphics RAM and type	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM	1MB DRAM	1MB VRAM	1MB DRAM	512K DRAM
Simultaneous external display	■	■	■	■	■	■	■	■
PCMCIA slots	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II or one Type III	Two Type II
Modem type installed	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps PCMCIA fax	14,400-bps internal fax	14,400-bps internal fax	14,400-bps PCMCIA fax
Power								
Rated charge time while on, off (hours:minutes)	3:00, 1:30	N/A, 1:30	8:00, 1:45	N/A, 1:45	8:00, 1:45	5:00, 2:00	5:00, 2:00	12:00, 2:00
Display/hard disk power-down	■■	■■	■■	■■	■■	■■	■■	■■
CPU/peripheral power-down	■□	□□	■■	■■	■■	■■	■■	■■
Standby/hibernation mode	■□	□□	■■	■■	■■	■■	■■	■□

N/A—Not applicable. The product does not have the feature. ❶ The travel weight includes the weight of the external floppy disk drive.

ACC—ACC Micro Electronics Inc., AMS—American Multisystems, BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DTI—Display Technologies Inc., FIC—First International Computer Inc., HP—Hewlett-Packard Co., NTC—Nan Tan Computer Co., SIS—Silicon Integrated Systems Corp., TI—Texas Instruments Inc., Vendata—Vendata Electronics Inc., WD—Western Digital Corp., ZDS—Zenith Data Systems.

other systems at the same price.

For this roundup, Twinhead sent three types of Slimnotes. All three are very similar, but the $4,899 high-end Slimnote 5100T differs the most. It's built around the DX4/100 processor, has a travel weight of 7 pounds 3 ounces, comes with an active-matrix color screen, and integrates a touchpad pointing device rather than the more familiar trackball. The Slimnote 550T and Slimnote 550S are based on the 486DX2/50 processor and weigh 7 pounds 3 ounces and 7 pounds 11 ounces, respectively. Both include a trackball and differ mainly in the display: The 500T offers an active-matrix color display and costs $3,799; the 550S has a dual-scan passive-matrix display, which lowers the price to $3,299. All three displays measure 9.5 inches diagonally.

On our intensive WinDrain test, the 5100T posted a battery life of 1 hour 37 minutes, and the 550S, 1 hour 53 minutes. Only the 550T climbed above the 2-hour mark, with a rundown time of 2 hours 17 minutes. Surprisingly, it outlasted the 550S and its dual-scan passive-matrix color display by almost 25 minutes. All three systems have a removable floppy disk drive; the remaining space can accommodate a second nickel hydride battery pack.

On our benchmark tests, the Slimnotes had average to above-average scores with a few exceptions. The 5100T's Winstone 95 score was among the best in its processor class; it posted a DOS Video score that was slightly above average. The 5100T, using a 520MB Toshiba hard disk, scored below average on our Disk WinMark 95 tests, but the Western Digital Rocket graphics accelerator chip set, found in all three Slimnote systems, helped to boost the unit's Graphics WinMark 95 score above its processor group's average.

The 550S and the 550T were the best performers in this processor class on our Winstone tests: The 550T posted the best Winstone score in this processor class and the 550S scored close behind. As with the 5100T, the Western Digital chip set helped these systems achieve average Graphics WinMark scores for their processor class. Though both systems used identical 340MB Toshiba hard disks,

Twinhead Slimnote 5100T

	Windows applications	DOS applications	Road warrior	Desktop replacement
Twinhead 550S	FAIR	FAIR	GOOD	GOOD
Twinhead 550T	FAIR	GOOD	GOOD	GOOD
Twinhead 5100T	EXCELLENT	GOOD	GOOD	EXCELLENT

the 550S's Disk WinMark score was well below average for its group; the 550T's score was average.

The pointing devices were centered under the keyboard with the buttons positioned smartly so an experienced typist could use both without any problems. The units aren't lacking features either; they offer easily removable hard disks, and their integrated PCMCIA slots can accommodate two Type II cards or one Type III card. There are additional ports on the sides of the units for external headphones and speakers. If you need further expansion, a $599 docking station with two ISA slots, a 5.25-inch drive bay, the I/O Slice, and a battery charger are available. The I/O Slice—a port replicator with all the notebook's ports—and an additional serial port, a SCSI-2 port, and a Type III PCMCIA slot are available separately for $199.—*WPF*

▶ **Twinhead Slimnote 550S, Twinhead Slimnote 550T, Twinhead Slimnote 5100T.** Twinhead Corp., *Milpitas, CA; 800-995-8946, 408-945-0808; fax, 408-945-1080.*

Circle 477 on reader service card

WinBook Computer Corp.

- **WinBook XP 486DX4/100 8/520 Active-Matrix**
- **WinBook XP 486DX4/100 8/520 Dual-Scan Color**

Following in the footsteps of the Editors' Choice-winning WinBook XP DX2/50 4/260 Monochrome (August 1994), the two DX4/100-based portables from WinBook Computer deliver three things that every buyer wants: attractive features, top performance, and a competitive price. For this review, we received an active-matrix system priced at $4,108 and a dual-scan unit, which sells for $3,059. Each system weighed in at just over 7 pounds.

The WinBook XPs offer an interesting and useful feature: your choice of pointing device. All WinBooks come with a pointing stick standard, but for an extra $29.95, you can purchase a 19-mm Logitech trackball module. In the first quarter of 1995, a touchpad module will also be available.

Both WinBook XPs have full-size keyboards, 8MB of RAM (standard), two Type II (or one Type III) PCMCIA slots, internal 14.4-Kbps fax modems, and 16550 UART support. Both also have removable hard disks: 513MB for the Active-Matrix, and 505MB for the Dual-Scan Color (currently the largest disks available). The XP Active-Matrix uses a 9.4-inch Hitachi display, while the Dual-Scan Color came with a 10.3-inch Sanyo screen (a 9.5-inch dual-scan panel is also available). The Active-Matrix came with an optional ($49) 8-bit audio board installed. A $399 docking station will be available for the WinBooks by the time you read this.

WinBook XP 486DX4/100 8/520 Active-Matrix

	Windows applications	DOS applications	Road warrior	Desktop replacement
WinBook Active-Matrix	GOOD	GOOD	GOOD	GOOD
WinBook Dual-Scan Color	GOOD	GOOD	GOOD	GOOD

Both units posted extremely competitive scores on our tests. The units tied for first place on the CPUmark$_{16}$ tests in the DX4/100 group. On the DOSmark tests, the Dual-Scan Color garnered the highest score of the DX4/100 units tested; the Active-Matrix placed second. On our Winstone 95 tests, the WinBooks' scores were average compared with other DX4/100 systems with 8MB of RAM installed. Powered by Western Digital chip sets, both units placed in the top five of their CPU group on the Graphics WinMark 95 tests.

On our WinDrain battery test, the XP Active-Matrix ran for 1 hour 40 minutes, and the Dual-Scan Color unit lasted just over 2 hours. Both units use nickel hydride batteries.—*CAV*

▶ **WinBook XP 486DX4/100 8/520 Active-Matrix, WinBook XP 486DX4/100 8/520 Dual-Scan Color.** WinBook Computer Corp., *Columbus, OH, 800-468-2162; fax, 800-448-0308.*

Circle 478 on reader service card

Zenith Data Systems

- **ZDS Z-Lite**

Zenith Data Systems' $2,128 ZDS Z-Lite subnotebook has a clear 7.8-inch passive-matrix color display, slim case, and reasonable travel weight of just under 6 pounds (including its external floppy disk drive). But its performance could not match that of most other reviewed systems.

The Z-Lite has a sloping keyboard that makes typing easier, but its keys are a bit

ZDS Z-Lite

	Windows applications	DOS applications	Road warrior	Desktop replacement
ZDS Z-Lite	FAIR	POOR	FAIR	FAIR

SUMMARY OF FEATURES

ENDS

Products listed in alphabetical order ■ = YES ☐ = NO	ZEOS Meridian 400A	ZEOS Meridian 400C	ZEOS Meridian 800A	ZEOS Meridian 800C
List price (tested configuration)	$3,695	$2,995	$3,995	$3,195
Processor type and speed	Intel DX4/100	Intel DX4/100	Intel DX4/100	Intel DX4/100
Dimensions (HWD, in inches)	1.7 x 10.2 x 8	1.7 x 10.2 x 8	1.9 x 11.7 x 8.9	1.9 x 11.7 x 8.9
System weight, travel weight	4 lbs. 1 oz., 5 lbs. 15 oz. ❶	4 lbs. 1 oz., 5 lbs. 15 oz. ❶	6 lbs. 5 oz., 7 lbs. 8 oz.	6 lbs. 5 oz., 7 lbs. 8 oz.
Display area and diagonal (inches)	4.8 x 6.3, 7.8	4.8 x 6.2, 7.8	5.9 x 7.7, 9.5	5.9 x 7.7, 9.5
Key size, distance between keys (millimeters)	12, 5	12, 5	13, 7	13, 7
Type of pointing device installed	Integrated pointing stick	Integrated pointing stick	Integrated pointing stick	Integrated pointing stick
DOS, Windows version included	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11
Warranty on parts/labor	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year
On-site service charge	None	None	None	None
Components				
Motherboard manufacturer	Sanyo	Sanyo	Sanyo	Sanyo
Chip set manufacturer	Pro Power	Pro Power	Pro Power	Pro Power
BIOS version (or date)	Phoenix (4/19/90)	Phoenix 1.03	Phoenix 1.03	Phoenix 1.03
Flash BIOS/16550 UART support	■■	■■	■■	■■
Installed/maximum system RAM	8MB, 20MB	8MB, 20MB	8MB, 20MB	8MB, 20MB
Installed/maximum external cache	N/A	N/A	N/A	N/A
Installed/maximum hard disk size	350MB, 350MB	349MB, 350MB	350MB, 350MB	349MB, 350MB
Screen manufacturer	Toshiba	Sanyo	Toshiba	Sanyo
Screen type	Active color	Passive color	Active color	Dual-scan color
Graphics chip set manufacturer	Cirrus Logic	Cirrus Logic	Cirrus Logic	Cirrus Logic
Graphics RAM and type	1MB DRAM	1MB DRAM	1MB VRAM	1MB DRAM
Simultaneous external display	■	■	■	■
PCMCIA slots	Two Type II	Two Type II	Two Type II or one Type III	Two Type II or one Type III
Modem type installed	None	None	None	None
Power				
Rated charge time while on, off (hours:minutes)	N/A, 1:00	N/A, 1:00	N/A, 1:00	N/A, 1:00
Display/hard disk power-down	■■	■■	■■	■■
CPU/peripheral power-down	■■	■■	■■	■■
Standby/hibernation mode	■■	■■	■■	■■

N/A—Not applicable. The product does not have this feature. ❶ The travel weight includes the weight of the external floppy disk drive

ACC—ACC Micro Electronics Inc., AMS—Americas Multisystems, BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DTI—Display Technologies Inc., FIC—First International Computer Inc., HP—Hewlett-Packard Co., NTC—Nan Tan Computer Co., SIS—Silicon Integrated Systems Corp., TI—Texas Instruments Inc., Vendata—Vendata Electronics Inc., WD—Western Digital Corp., ZDS—Zenith Data Systems.

cramped. For a pointing device, the unit uses a J-Mouse—the normal J key altered to function as a pointing stick when fully depressed and held down. The space bar acts as the left mouse button and other key combinations give you middle and right mouse buttons. This takes a bit of getting used to but is functional. ZDS also offers its $89 Litepoint trackball as an option.

The system came with 8MB of RAM and a Seagate 209MB hard disk; maximum RAM is 12MB, and the largest available hard disk is 340MB. The Z-Lite also has two Type II PCMCIA slots, one high-speed serial port, and one parallel port. To complement the system, ZDS offers a $499 Z-Player (with a double-speed CD-ROM, two stereo speakers, and a built-in microphone) that connects via a Type II PCMCIA card.

The Z-Lite had the only Cyrix Cx486DLC/33 CPU here. Its performance was below average across our tests compared with other 33-MHz units, except for its above-average Disk WinMark 95 score. On the WinDrain test, its nickel hydride battery lasted 1 hour 38 minutes.

Documentation is nice: The manual is on the hard disk and is easy to use. ZDS also sells two other portable lines: the entry-level Z-Star and the more full-featured Z-NoteFlex, which has user-upgradable components and built-in sound.—*AY*

► **ZDS Z-Lite.** Zenith Data Systems, *Buffalo Grove, IL; 800-289-0536, 708-808-5000; fax, 800-472-7211.*

Circle 479 on reader service card

ZEOS International Ltd.

- **ZEOS Meridian 400A**
- **ZEOS Meridian 400C**

The new ZEOS Meridian 400s are the only subnotebooks in this roundup powered by Intel DX4/100 CPUs. The Meridian 400s also come with 7.8-inch color displays; the passive-matrix Meridian 400C costs $2,995, and the active-matrix Meridian 400A is competitively priced at $3,695. The 400A is a better performer; for those needing a powerful subnotebook, it should fill the bill. If cost is a major concern, the 400C is a sound purchase. ZEOS's more full-featured line, the Meridian 800 series, is reviewed separately.

The Meridian 400s weigh just under 6 pounds, including their external floppy disk drives and AC adapters. The units came with 8MB of RAM, which users can upgrade to 20MB. The Meridian 400s also come with two Type II PCMCIA slots; but since each slot is on an opposite side of the system, Type III cards cannot be used. Both units have TruePoint pointing sticks that are placed on the wrist rest rather than in the middle of the keyboard, where they're more commonly found. The Meridian 400s use a Cirrus Logic chip set that can display external resolutions of up to 1024-by-768 with 256 colors.

Our WinDrain tests determined that the 400A has a battery life of 2 hours. Surprisingly, the passive-matrix 400C lasted only 1 hour 16 minutes. These systems can recharge only while inactive.

The Meridian 400s fared reasonably well on our benchmark tests. The units' $CPUmark_{16}$ scores were average for their processor class. Winstone 95 performance was average for the 400A; the 400C had a slightly lower score. Graphics WinMark 95 scores were average for the 400C and just below average for the 400A. Though both Meridian 400s come with 350MB hard disks, their Disk WinMark 95 scores were quite different: The 400A scored above average; the 400C's score was average.

Their cases provide a high level of shock resistance because they are a combination of plastic and carbon fiber. Side benefits of carbon fiber are that it is lighter and dissipates heat faster than plastic, so the case will not get uncomfortably warm. ZEOS also uses its keyboard backplate as a heat sink to dissipate CPU heat.—*Marino Delzotto*

► **ZEOS Meridian 400A, ZEOS Meridi-**

ZEOS Meridian 400A

	Windows applications	DOS applications	Road warrior	Desktop replacement
ZEOS 400A	GOOD	GOOD	GOOD	FAIR
ZEOS 400C	GOOD	GOOD	FAIR	FAIR

an 400C. ZEOS International Ltd., *Minneapolis, MN; 800-554-7172, 612-362-1234; fax, 800-362-1205.*

Circle 480 on reader service card

ZEOS International Ltd.
- **ZEOS Meridian 800A**
- **ZEOS Meridian 800C**

The ZEOS Meridian 800 line was jointly developed with Sanyo and is sold exclusively by ZEOS International. The $3,195 ZEOS Meridian 800C has a passive-matrix, dual-scan color display; the ZEOS Meridian 800A, which uses an active-matrix color screen, is priced at $3,995. These systems weigh 7 pounds 8 ounces each and are powered by DX4/100 processors. Though these solid performers do not offer sound capabilities, their full-size keyboards and ergonomic TruePoint pointing sticks make them some of the more user-friendly notebooks in this roundup. ZEOS also sells a subnotebook line, the Meridian 400 series, which is reviewed separately.

The Meridian 800 notebooks include good-size 9.5-inch color displays. The systems' graphics are powered by Cirrus Logic's CL-GD6440 chip sets and 1MB of DRAM, allowing the Meridian 800s to display external resolutions of up to 1,024 by 768 pixels. The colors on the 800A active-matrix system are rich and easy on the eyes; the color produced by the 800C's dual-scan screen isn't as crisp.

The Meridian 800s offer a good amount of expansion potential. Both integrate two Type II PCMCIA slots (also usable as one Type III slot). A user can easily upgrade the Meridian 800's 8MB of RAM to 20MB and change the removable hard disk simply by removing one screw. Both test systems came with 350MB hard disks—currently the largest available. There is no docking station available for these units.

ZEOS uses nickel hydride batteries in its Meridian 800s. On our WinDrain test, the 800A had a battery life of 2 hours 20 minutes, while the 800C lasted for 1 hour 43 minutes; these scores are average for this class of system. One caveat: Don't plan on recharging the battery while you work; the battery can charge only when not in use. ZEOS supplies an extra battery and carrying case with the Meridian 800s.

The Meridian 800s' Winstone 95 and CPUmark$_{16}$ benchmark test scores were average for their processor class. On the Graphics WinMark 95 benchmark tests, the 800C garnered a below-average score; the 800A's score on this test was average. Their above-average scores on the Disk WinMark 95 tests make these systems average performers overall.—*MD* □

ZEOS Meridian 800A

	Windows applications	DOS applications	Road warrior	Desktop replacement
ZEOS 800A	GOOD	GOOD	GOOD	FAIR
ZEOS 800C	GOOD	GOOD	GOOD	FAIR

▶ **ZEOS Meridian 800A, ZEOS Meridian 800C.** ZEOS International Ltd., *Minneapolis, MN; 800-554-7172, 612-362-1234; fax, 800-362-1205.*

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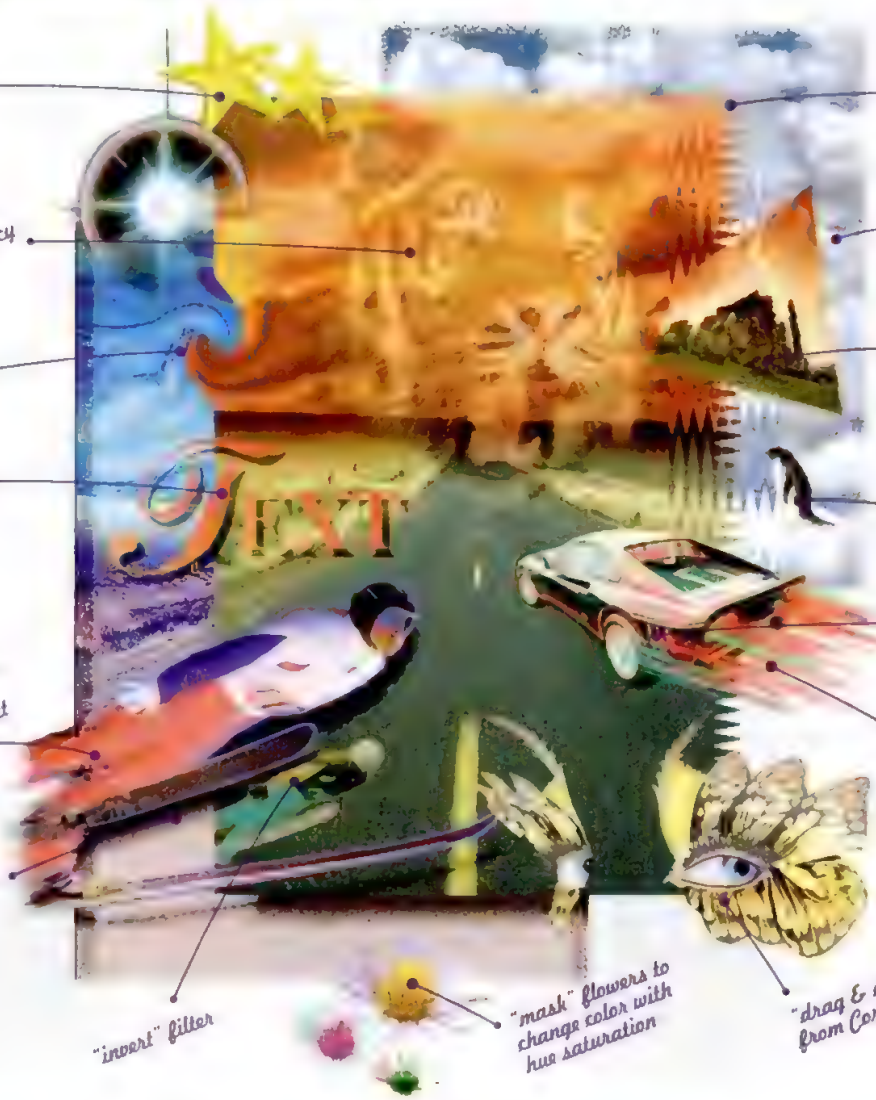

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PHOTO ILLUSTRATION

Image Is *Everything*

Today's digital artists rely on a collection of tools that includes image editors, 24-bit paint products, and a healthy dash of filters to produce their photo illustration art.

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By Lance Ulanoff and Jeff Mace

When photographers produce images awash in vibrant colors and tones that echo the effect of a brush on canvas, we say their work shows evidence of a painter's eye. And when a painter creates works so starkly realistic that we have to put our nose to the canvas to see the brush strokes, we say their work has a photo-realistic style. Considering the links between these otherwise distinct mediums, it's only natural that they find a common ground electronically. That union has resulted in a new category of graphics software: *photo illustration*.

Photo illustrations frequently begin as scanned photos that are combined with a variety of special effects and painted elements. Photo illustration tools give you total control over an image, including the ability to alter lighting and shadows and the ability to create or alter reflections. They have made surrealistic images such as a man swimming on the moon's surface commonplace.

Just as photographers use multiple lenses and cameras, and painters use multiple media (oil, water colors, airbrush), photo illustrators regularly employ a variety of tools including image editors, paint tools, and add-on filters to create their often striking imagery. In this review, we evaluate four image editors, Adobe Photoshop, Version 3.0 for Windows, Picture Publisher 5.0 for Windows, Image-In Professional Pack, Version 3.20, and PhotoPaint 5 Plus, as well as two 24-bit paint products, Fauve

Photo illustration by David Kahl

Suitability to Task: Photo Illustration

In rating photo illustration packages, we give fair play to each package's painting and image-editing features. Because photo illustration packages represent an intermingling of image-editing and paint tools, some packages' strengths are concentrated in only one of these two areas.

Each package gets rated with two types of scores: *Power* and *Ease of Use*. *Power* refers to the wealth and strength of features offered to solve a given task, while *Ease of Use* refers to the way each package implements these features. Keep in mind that a package that is easy to use does not necessarily give you powerful photo illustration tools.

We rate these packages in four areas: Image Editing, Image Painting, Customization, and Color Support. Since most of these packages have complex features, our ratings should offer an idea of what kind of learning curve to expect.

SUITABILITY TO TASK

Product name

	Power	Ease of Use
Image editing	EXCELLENT	POOR
24-bit image painting	GOOD	FAIR
Customization	FAIR	GOOD
Color support	POOR	EXCELLENT

In rating **image editing** features, we evaluate how well each package implements its masking tools and anti-aliasing algorithms. Packages earning an Excellent in this category must have robust Bezier-curve or spline-curve vector drawing tools, which are essential for creating a precise selection path. They must also be able to convert that path to a bitmap selection with smooth edges. Excellent packages also have the ability to blend images with a mask or alpha channel.

In our **24-bit image painting** category, we rate a package's control over transparency in brush strokes and paint styles. We also look at a package's offering of paint media and whether the user can define his or her own variation on each. The high-scoring packages in this area have paint tools that successfully replicate the appearance of natural media. Additionally, we examine a package's built-in special-effects filters.

Our **customization** rating comprises several components. We evaluate a package's support for the Adobe plug-in standard (for third-party plug-ins), as well as its ability to save custom settings for filters. Our highest rating goes to packages that let the user customize and save brush size, brush type, brush mask, and color palettes.

We rate a package's **color support** in terms of both input and output. We evaluate support for different color modes, such as RGB, CMYK, and NTSC. Packages earning a high rating in this category support standard lookup and color-compensation tables. They also offer solid support for conversion to CMYK. If a package does not have a color-matching system, it receives a rating of *poor*. Packages that include CMYK palettes (such as TrueMatch) receive a rating of *good*.

Matisse, Version 1.26, and Fractal Design Painter 2.0 with PainterX2—all of which contain such tools.

The common threads among these software products are their need for powerful processors and a healthy amount of RAM and their support for pressure-sensitive digitizing tablets (see the sidebar "Digitizing Tablets: Tabula Rasa").

Although all six products faced the same series of image composition and creation tasks in our testing, it's doubtful anyone will settle on one tool for all their photo illustration needs. In fact, Adobe's plug-in API has spawned a cottage industry that now regularly produces add-on utilities, filter collections, and unusual textures that work with all applications that support the API. For a look at how some of these tools fit into the big picture, see our illustrated sidebar "Special Fx: Using Plug-In Filters."

In the year since we last covered image editors ("Has the Mac Met Its Match?", October 12, 1993), and two years since our last full review of 24-bit paint products ("In Living Color," December 8, 1992), both categories have seen many changes. Only a handful of 24-bit Windows-based paint products remain today,

HIGHLIGHTS

Photo Illustration

A MERGER OF SORTS: High-end image-editing tools and 24-bit paint programs can be gathered under the overall umbrella of photo illustration. This type of art can best be described as the creation of new and composite images to achieve both surreal and stunning images.

THE HIGH-END FUNCTIONALITY of products such as Fractal Design Painter and Adobe's Photoshop sometimes detracts from their usability. Graphics professionals will quickly forgive these oversights, while business users will turn to image-enhancing utilities.

NO ONE KILLER APPLICATION exists—yet. Artists will continue to choose an image editor *and* a 24-bit paint tool for their design tasks. In addition, they will add at least one plug-in tool for filters, textures, and special effects.

DEVELOPING COMPOSITE IMAGES is an essential part of most professional graphics projects. Photo illustration tools for power users have defined themselves with powerful masking tools and strong anti-aliasing algorithms to create composite images, which belie their multiple-image and multiple-object origins.

EASE ISN'T EVERYTHING. Micrografx's Picture Publisher has succeeded in creating powerful tools that are often easier to use than those found in Photoshop. But in spite of some useful features like the Command List, Picture Publisher's core engine may still fail to satisfy the power photo illustrator.

and they're quite different from the bitmap-based editors of yesterday; they now rely heavily on mathematical algorithms to produce their natural media emulations.

We've also witnessed shifts in the image-editing arena. Some products have made dramatic appearances only to disappear quickly. One, Altamira Software's Composer, may no longer be updated. Thanks to a merger between Altamira and Microsoft, Altamira's innovative, object-based imaged editing metaphor will most likely reemerge in a product from Microsoft's Advanced Technology Group. And Adobe's acquisition of Aldus Corp. continues to have reverberations throughout this market, among them the demise of Aldus Photostyler.

The delayed release of Windows 95 has forestalled wholesale migration to true 32-bit operation and also to the Windows NT platform. With the exception of Photoshop, none of these products can yet take full advantage of the multithreading/multi-processor capabilities currently found in Windows NT 3.5.

In the meantime, those craving multithreading on NT 3.5 will turn to Photoshop, or accept interim solutions such as the ability of Picture Publisher and Photoshop to open and edit a portion of a high-resolution image, or Picture Publisher's option to edit in a low resolution. This last option, in combination with Picture Publisher's innovative Command List feature, is a first glimpse on the PC of *resolution-independent* editing.

AN ILLUSTRATIVE FUTURE

When we next look at this category, we'll have several multi-processing options to examine, including products like Ron Scott Inc.'s QFX for Windows NT (713-529-5868), which wasn't ready in time for this evaluation. QFX will feature such next-generation tools as multithreading, image warping, shading, and realistic image effects.

We'll also be watching HSC. The developers of the amazing Kai's Power Tools still have quite a few other tricks up their sleeves. HSC's Macintosh-based resolution-independent image editor, Live Picture, has generated a lot of excitement, and the 3-D image creator/renderer KPT Bryce, also Mac-based, has left many PC users shaking their heads in wonder. Although a Windows version of KPT Bryce is expected sometime next year, HSC has yet to announce any plans to port Live Picture to the PC environment.

In a society where image is everything, these photo-illustration tools represent genuine power. You can alter reality in ways that are both subtle and outrageous. How far photo illustration artists will go, and in what direction, is limited only by their imaginations.

PC MAGAZINE EDITORS' CHOICE

- **Adobe Photoshop, Version 3.0 for Windows**
- **Fractal Design Painter 2.0 with PainterX2**

Few photo illustration artists rely on just one tool to get the job done—not so much because one product fails in some area, but because each one performs a particular function so well. Our tests revealed two such products: Adobe Photoshop, Version 3.0 for Windows, the top image editor, and Fractal Design Painter 2.0 with the X2 extension, the top 24-bit paint product.

Photoshop has long been lauded as one of the most powerful graphics engines ever written for a PC, and Adobe wants to maintain that reputation. The new version has more alpha-channel control and a far better anti-aliasing algorithm to produce composite images that don't suffer from jagged edges. Photoshop still isn't easy enough to use, but it outperforms Micrografx Picture Publisher when you need precision composition and high-quality control of output.

Can Photoshop learn anything from Picture Publisher? Certainly. Smart Picture Publisher ideas like image browsing, the ability to open multiple images from the file menu, low-resolution editing, and a command list are worth Adobe's attention. In fact, Picture Publisher's easy-to navigate interface and time-saving features make it a great solution for business users less interested in fine artistic tweaking.

While Corel's new PhotoPaint made an impressive first-time appearance, it will likely be used for business apps until its object handling is extended and its masking abilities improved. Image Inc.'s Image-In Professional, on the other hand, limped through our tests and will need a complete overhaul before it becomes competitive.

Fractal Design Painter is unmatched in its ability to simulate natural painting styles and media, including oil paint, charcoal, paper textures, and the like. Its staggering flexibility—you can build almost any brush style for any medium you can imagine—and superb integration with pressure-sensitive input devices has put Painter in a class by itself. Its nearest competitor, Fauve Matisse, tries hard to achieve the same natural media emulation, but it needs to mature. Painter can be seen as somewhat complex and even difficult to learn, but Fauve Matisse's simplicity sometimes results in awkward functionality. Version 3.0 of Painter, which wasn't released in time for this evaluation, will have a new interface and all the functionality of the X2 extension built-in.

Our Contributors: SALLY WIENER GROTTA is an imaging consultant; DON LABRIOLA speaks and writes about new technology; and MARLA G. MILNE is a Manhattan-based graphics designer. All are frequent contributors to *PC Magazine*. GAYLE EHRENMAN is an associate editor, KATHLEEN CASTER is a staff editor, and DANIEL A. BEGUN is a technical analyst at *PC Magazine*. LANCE ULANOFF was the associate editor in charge of this story, and JEFF MACE was the project leader.

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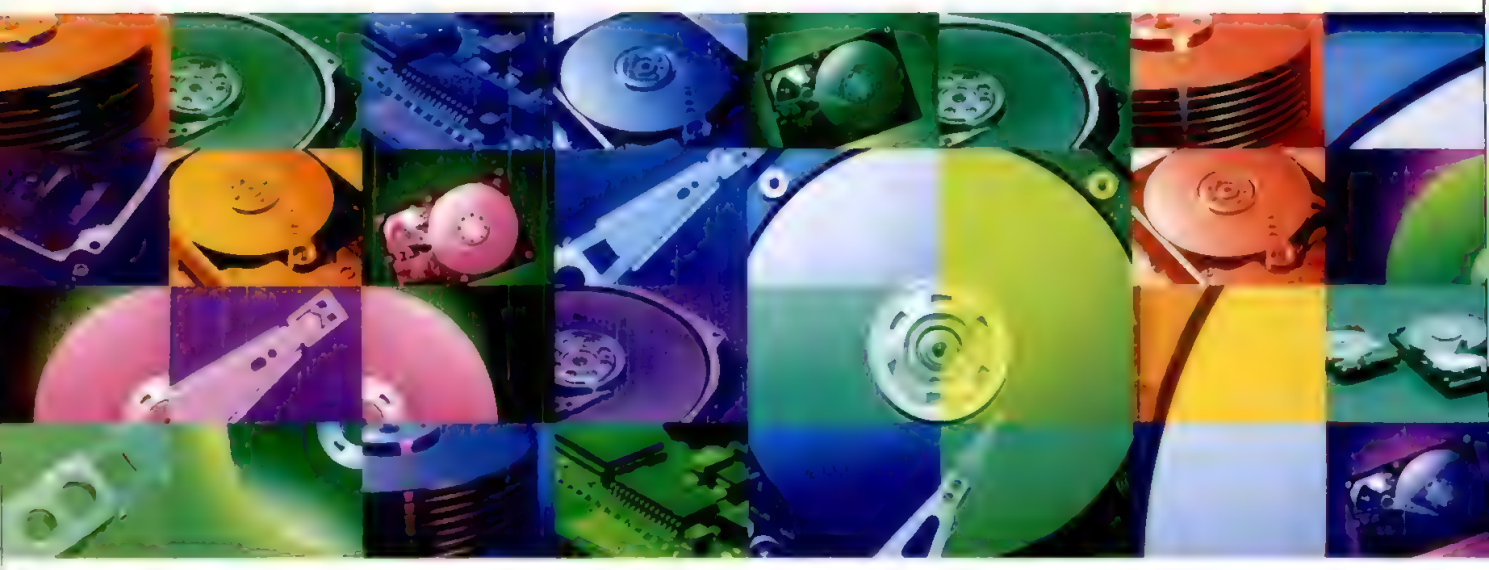

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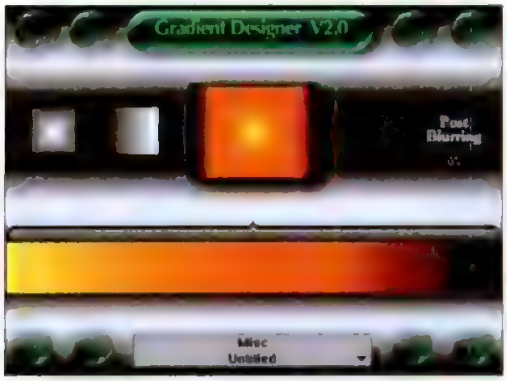
CIRCLE 271 ON READER SERVICE CARD

Special Fx: *Using Plug-In Filters*

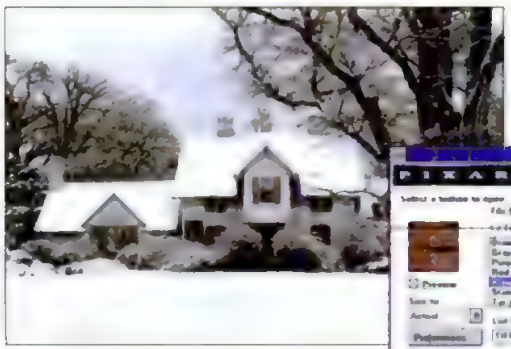
By Kathleen Caster

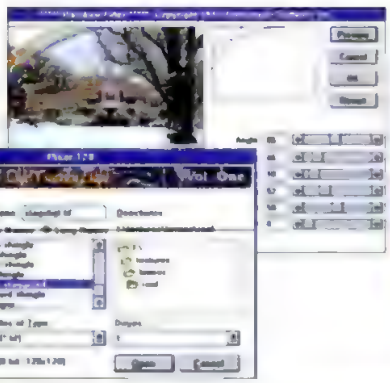


We used Kai's Fractal Explorer (above, right) and Gradient Designer (below, left) extensions to apply a fractal to the winter scene, manipulate the colors of the fractal, and apply all these effects in a procedural blend with the photo. You can save your settings in both of these extensions. (Kai's Power Tools, Version 2.0, $199; HSC Software Corp., 805-566-6200.)

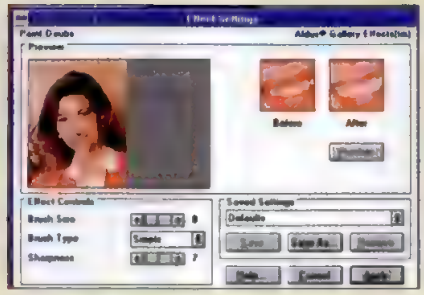
Third-party add-ins written to the Adobe plug-in standard have put special-effects filters in the hands of business users and professionals alike. Straightforward, useful filters let you apply roof and fabric textures, as well as halo and prism effects. The more intricate—and stunning—filters, typified by Kai's Power Tools Extensions, are based on complex mathematical algorithms and fractals. Thanks to these, you can alter and enhance your work in more ways than you can imagine.

For each example, we show the original image at left, usually followed by the filter interface(s). The resulting image is on the right. □

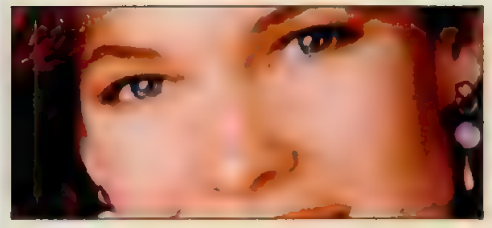


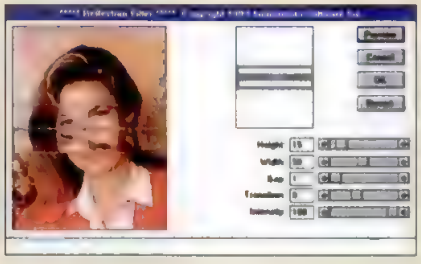


In this image, we've combined Pixar's Brown Staggered shingle texture (center, left) and Andromeda's Rainbow filter (center, right). Both filters use an interface step-through and provide previews. The shingle is one of many textures provided with Pixar. The Rainbow filter can be modified in terms of angle, radius, and width. (Pixar One Twenty-Eight, Version 1.0, $299; Pixar Inc., 800-888-9856, 510-236-4000.)

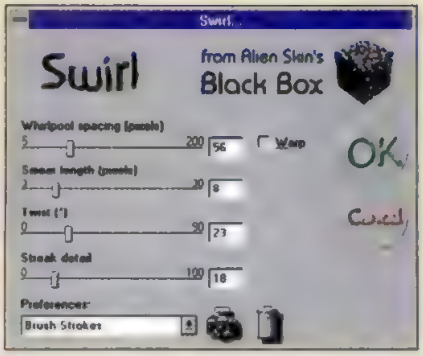


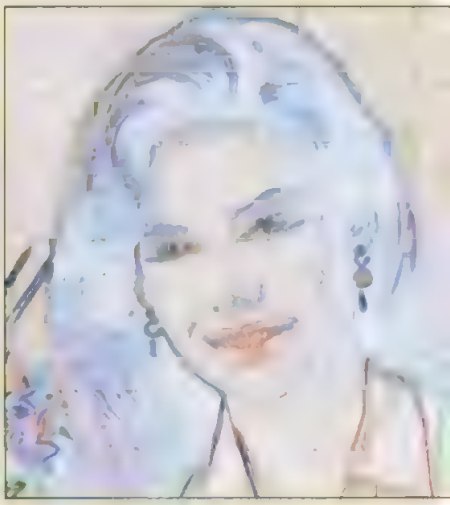
This picture shows the application of two Aldus Gallery Effects—the Craquelure effect from Volume 1 and the Paint Daubs effect from Volume 3. Both involve an interface step-through with previews, although we show only the Paint Daubs interface. The Craquelure effect gives your selection the look of a cracked oil painting. The Paint Daubs effect softens the image and makes the colors look as if they've been applied with a brush. (Aldus Gallery Effects, Adobe Systems Inc., $149 per volume; 206-622-5500, 800-628-2320.)





Here we've combined Andromeda's Reflection filter and Kai's Smudge Right-Darken filter (the latter involves only one step). The Reflection filter has obvious uses, such as the reflection of a tree in a pond. The Smudge filter provides a more subtle, yet dramatic, effect. You'll find more single-pass filters in Kai's Power Tools, such as Pixel Breeze, Grime Layer, and Vortex Tiling. Andromeda's Series 1 Photography Filters include Halo, Prism, and Velocity. Andromeda Series 2 Three D filters let you wrap your selection to a 3-D surface. (Andromeda Series 1 Photography Filters, Version 1.4, $129. Series 2 Three D Filters, Version 1.4, $129. Andromeda Software Inc., 805-379-4109, 800-547-0055.)





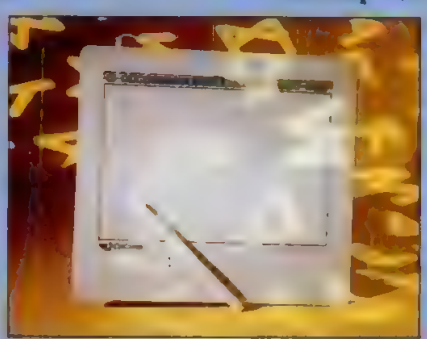
This image shows the effects of Kai's Find Edges and Invert single-pass filter, as well as The Black Box's Swirl filter. Find Edges and Invert makes your image look somewhat like an embossed, colored negative. The Swirl filter makes it look as if the colors have been applied in whirling brush strokes. The Black Box effects also include Drop Shadow, Glow, Emboss, Glass, and Noise filters. Each one provides several customizing options. (The Black Box, Version 1.2, $89; Alien Skin Software, 919-832-4124.)

Digitizing Tablets: *Tabula Rasa*

By Don Labriola

Using a program like Photoshop with a mouse is like playing the piano wearing mittens. High-end photo-illustration packages work far better with a drawing tablet and pressure-sensitive pen, devices that closely mimic such traditional drawing tools as brushes, pencils, and markers.

Today's drawing tablets are descendants of the large, expensive digitizing pads used by CAD engineers to define (or "digitize") *x,y,z* coordinates and select functions from printed menu overlays. The best of the new crop are lighter and cheaper, and can coexist under Windows with a mouse—no small feat in an environment normally restricted to a single pointing device. They should also support both Microsoft's Pen Extensions for Windows, which Photoshop needs to handle pressure-sensitive devices, and the industry-driven WinTab (Windows Tablet Interface) specification used by most other photo-illustration packages.

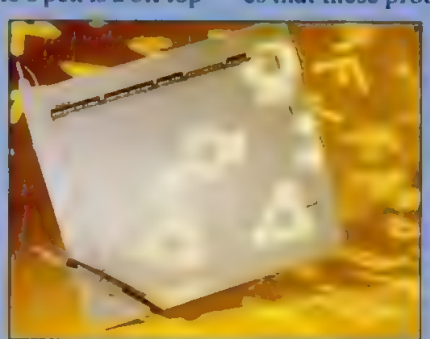


CalComp's DrawingSlate

Another common feature is the ability to toggle between absolute and relative tracking modes. In absolute mode, a tablet acts like a CAD digitizer, associating each point on its surface with a fixed screen coordinate: Whenever you click a particular spot on the tablet, the cursor always jumps to the same location on the screen. Relative mode makes the pen work like a mouse, moving the cursor from its current position regardless of where you initially click the tablet. The seven models we evaluated all include cordless pressure-sensitive pens and can also be configured with 4- or 16-button wireless mouse-like devices called pucks or cursors. Most offer scaling capabilities that can control the tablet's acceleration factor and resolution by mapping a portion of its surface to the entire screen. Transparent plastic overlays, which are useful for tracing, are also common.

- **CalComp's $395 DrawingSlate** features a 6- by 9-inch drawing area, a 256-level pressure pen, and a menu strip that provides single-click macro execution. Its unique features include Dynamic Windowing, which lets you switch applications by passing the pen over predefined locations, a power-conserving sleep mode, and an intelligent configuration database that automatically loads a tablet setup whenever you launch an application.

The DrawingSlate's pen is a bit top-heavy and its smooth, tubular design sometimes makes it hard for your hand to find its two programmable side-buttons. But the DrawingSlate was fairly comfortable and responsive enough to produce credible results with Photoshop and Fractal Design Painter.



Hitachi's MultiPad

The tablet's fatal flaw is its two Windows drivers: They don't support WinTab, the Pen Extensions, or concurrent mouse operation, nor do they use most of the DrawingSlate's best features, including Dynamic Windowing, intelligent configuration, and scaling management. CalComp promises to resolve these problems early this year (and add features like pressure-sensitivity control); but until then, you should consider this otherwise excellent product only if you don't need its more advanced functionality. (CalComp Digitizer Division, 800-458-5888.)

- **Hitachi's $249.95 MultiPad** is the lowest-priced 6- by 9-inch tablet in our survey, but boasts solid specs like 2,540-lpi resolution and +/- 0.007-inch accuracy. Its 256-level, cigar-shaped pen is responsive enough, but isn't quite as comfortable as the Wacom or Kurta pens and has only one side button.

The MultiPad's application software isn't fancy, but does cover the essentials, such as tracking mode, cursor acceleration, scaling, and click pressure. There's also a menu strip, but it doesn't do much more than load hardware setups and run a self-test. Our evaluation unit lacked Microsoft Pen support and was unable to coexist with a bus mouse, but Hitachi promises that these problems will be solved by the time you read this. (Hitachi Digital Graphics (USA) Inc., 408-747-0777.)

- **The $395 Kurta XGT 6" x 8"** is a 6- by 8-inch tablet with specs that rival those of the MultiPad and an outstanding pen equipped with two tactile-feedback side buttons. Comfort and responsiveness while painting or tracing are excellent, but the tablet's greatest strengths are its sophisticated menu strip, flexible software utilities, and excellent documentation.

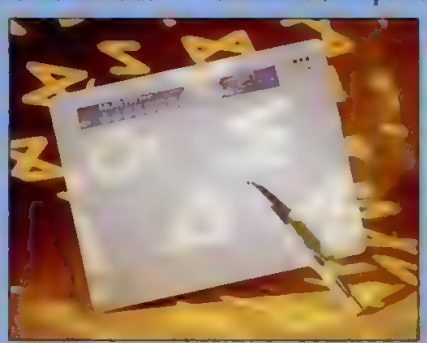
Installation and configuration were surprisingly easy and produced no conflicts with our mouse. Menu-strip

buttons load any of 60 predefined "personalities" that specify setup configurations and tablet or mouse emulations. Defining scaling parameters is as simple as clicking a button and tapping two points. Other buttons let you load pressure-sensitivity curves, play macros, and reconfigure the pen buttons. You can also increase precision by mapping the entire tablet surface onto a portion of the screen, and even define multiple tablet regions that are active at the same time.

The XGT's one drawback is that it's always in absolute mode. But other than that, it's the most flexible and easy-to-use product in the roundup. (Kurta Corp., 800-445-8782.)

• **Numonics' $649 Quora-XNT Cordless Pressure-Sensitive Digitizing Tablet,** at first glance, seems too good to be true. It claims an astounding 512 pressure-sensitivity levels (twice that of any other tablet in our survey), boasts a spacious 12- by 12-inch surface, and is the only non-Wacom product to include a battery-less pen.

Unfortunately, our evaluation unit supported only 128 pressure levels (the new 512-level model with transparency overlay was not available at press time), and its low 1,000-lpi resolution negates many of the benefits you'd expect from a 12-inch surface. The large, uncomfortable pen produces a signal too weak for reliable tracing through heavy stock and lacks programmable side buttons, forcing you to double-click with the tip (a task made difficult by the pen's stiff, unresponsive action). The tablet also lacks a transparent overlay.



Kurta's Kurta XGT

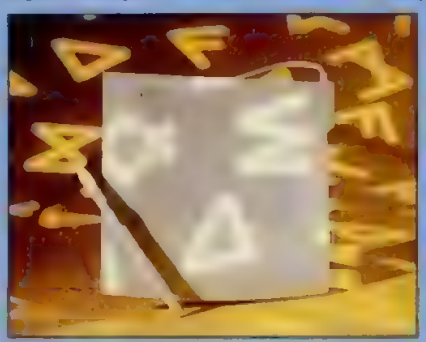
The Quora XNT's menu strip offers some useful macro and scaling capabilities, but its other deficiencies make it a poor choice for artists. (Numonics Corp., 800-247-4517.)

• **Summagraphics' SummaSketch FX** is another $649 12- by 12-inch tablet that features 2,540-lpi resolution, 256 pressure levels, and a unique pen that can operate with or without a cord. The FX has no menu strip, but it lets you record mouse-click macros and assign them to the pen's tip and two side buttons. The pen provides realistic response, and its triangular shape helps you locate the side buttons without looking at your hand.

The SummaSketch FX's large size and high resolution are great for precision drawing,although its rough surface makes it hard to draw without jerkiness. We also had many driver problems that were aggravated by poor documentation: We never got the FX to coexist with a mouse, and the Windows driver doesn't provide basic features like cursor acceleration, Pen Extensions compatibility, and tracking-mode selection.

For its size, the SummaSketch FX is a low-cost solution that, under the right conditions, will provide satisfactory results. But if you can live with a smaller tablet, the Kurta XGT 6" x 8"and Hitachi MultiPad both cost less and deliver more. (Summagraphics Corp., 800-444-3425.)

• **Wacom's $199 ArtPad** features a tiny 3.8- by 5-inch active surface area and includes Wacom's trademarked UltraPen battery-less stylus, which is often touted as the lightest and most comfortable cordless pen in the industry. Comfort, of course, is a matter of taste—users with larger hands may consider the UltraPen a bit too light and, by today's standards, its single side button seems confining. But the UltraPen still feels more like a real pencil or ballpoint pen than any other stylus in our survey, providing subtle, brush-like response and never tiring our hands during long sessions.



Wacom's ArtPad

The ArtPad's small size makes it easy to hold in your lap or use on a plane, and it also lets you draw without lifting your hand. Scaling, however, is limited: You can map the entire drawing surface to a portion of the screen, but can't go in the other direction. Tracing anything larger than a post card is also difficult, a problem worsened by the ArtPad's lack of an overlay and by the difficulty of tracing through heavier paper.

The superior Wacom software and documentation make these limitations easier to take by providing flexible control over such characteristics as pressure-sensitivity, cursor acceleration, and double-click detection. Furthermore, installation is easy, and the tablet coexists well with a mouse.

• **Wacom's $499 ArtZ** is a 6- by 8-inch version of the ArtPad that adds features such as a transparent overlay, a power switch, and the ability to scale in either direction. It provides only 120 pressure levels and 1,270-lpi resolution, but Wacom plans to increase these figures this year to match the ArtPad's 256 levels and 2,540 lpi. Not surprisingly, our evaluation wasn't quite as responsive as newer models like the ArtPad, Kurta XGT, and Hitachi MultiPad, although it did produce decent results.

When the next version of the ArtZ appears early this year, its excellent pen and mature, stable software coul make it a contender (especially if Wacom adds some menu-strip functionality). The current model, however, is starting to show its age. (Wacom Technology Corp., 800-922-6613.) □

Cross-Platform Tests: *Photoshop's Many Personalities*

By Daniel A. Begun and Jeff Mace

Adobe Photoshop 3.0 is the only professional-level image editor in our review group that is available on multiple platforms, so we decided to test the four available platforms using some of Photoshop's most commonly run tasks.

We installed Photoshop 3.01 on a Power Macintosh 8100/110, which has 64MB of RAM and uses a PowerPC 601 processor running Macintosh System 7.5. Our Windows systems were tested with Photoshop 3.0 on two HP Vectra XU 5/90C systems that had Pentium 90 processors and 64MB of RAM; one ran Windows 3.1 and the other Windows NT 3.5. We used a Matrox MGA Ultima Plus graphics accelerator with 4MB of RAM and Photoshop 2.5.2 on a Sun SPARCstation 20, which had 128MB of RAM and was running SunOS, Release 5.3. We asked Apple Computer and Sun Microsystems to install the accelerated 24-bit graphics board of their choice for the best performance in their systems.

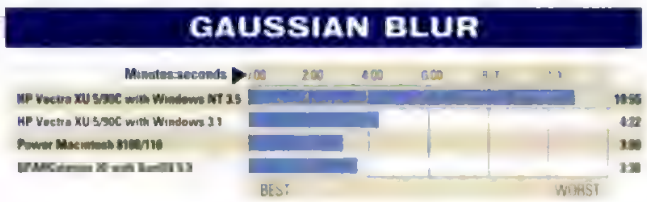
We performed four separate performance tests. For the Arbitrary Angle Rotate test, we rotated a masked region of an image 153 degrees counterclockwise using a 12.5MB TIFF file. For Motion Blur, we set the filter to 7 degrees and 40 pixels, with Preview turned off. The Gaussian Blur test was done on a 48MB file of a second-generation halftone image with Gaussian Blur set to 6.5 pixels, and with Preview turned off. The File Open test was done using the 48MB file.

Of the four platforms, both the Sun SPARCstation 20 and the Power Macintosh produced, in most cases, notably better results than the remaining two. We attribute the PowerMac's performance to the processor running at 110 MHz and the superior performance of the floating-point unit of the PowerPC.

The Sun system turned in the fastest scores on two of the four tests. This can be attributed, in part, to the 56MB of the 128MB of system RAM dedicated to the SX graphics accelerator card. Sun recommends the SPARCstation 20 be configured with at least 96MB to see any acceleration. The tests we performed using only 64MB of total system RAM, with only 6MB dedicated to the SX card, had markedly slower results (not shown here).

Although the Windows 3.1 and Windows NT 3.5 systems were installed on identical hardware, Windows 3.1 proved considerably faster overall due to Photoshop's conflict with Windows NT's initialization of virtual memory. Since the total amount of virtual memory required by Windows NT was being requested as the tests were run, Photoshop was prevented from achieving the "steady state" in memory that it needs to perform optimally. Adobe is aware of this and promises that a patch will be available by the time you read this.

On the Arbitrary Angle Rotate test, the Macintosh and the Windows 3.1 systems turned in nearly identical scores. □



Adobe Systems Inc.

EDITORS' CHOICE

Adobe Photoshop 3.0 for Windows

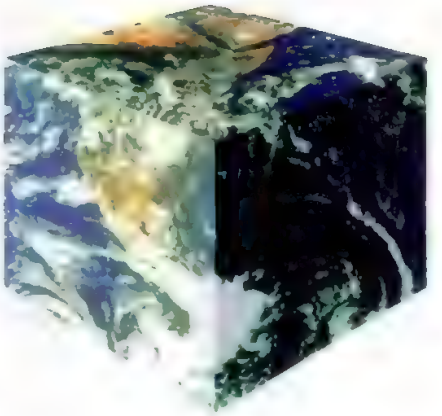
BY SALLY WIENER GROTTA

Since its introduction in 1990, Adobe Photoshop has been the leading imaging program on the Macintosh. On the Windows side of imaging, however, competitors have been much more aggressive and innovative. Compared to recent new versions of other programs, Photoshop for Windows was beginning to look a little long in the tooth, but with the release of Version 3.0 ($895), Photoshop has entered the modern era of photo illustration, setting new and higher standards for this category of software.

Layers are the big news with Photoshop 3.0. They let you place pieces of a composite image on top of each other, and all of the layer information remains intact, even if you can see only a portion of it in the document. An exception is that the perspective tool can use only the layer information that's visible in the picture.

THE LAYERED APPROACH

In the image editing portion of our tests, each item in the final composite started out as a separate image. To create a layered picture, we dragged each item onto the final image. In the process, we made each item a layer, and associated a mask



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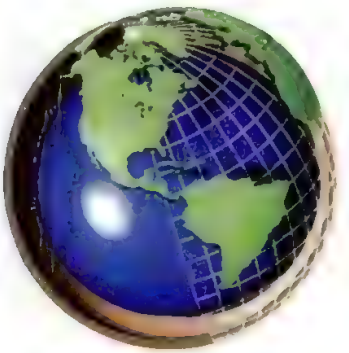

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CIRCLE 361 ON READER SERVICE CARD

Performance Tests: Photo Illustration

How We Tested

All our review products were tested on systems that had a 24-bit graphics adapter and a Wacom ArtZ pressure-sensitive tablet with a stylus. We used the Tektronix Phaser 480 thermal dye transfer printer to print color proofs and HSC Software's Kai's Power Tools 2.0 to test support for the Adobe Plug-in standard.

Test Image 1

The PC Labs photo illustration testing script is divided into two primary design tasks: image editing and image painting. Keep in mind that these tests generally correspond to the Image Editing and 24-bit Image Painting tasks in our Suitability to Task ratings, which also include customization and color-support tasks.

Our **Image Editing** test series consisted of building an image we call Time is Money (see image at left). The goal was to produce a conceptual composite image that would be typical of the art designed for an advertising agency. The components of the graphic were seven CMYK scans done on a drum scanner at Res 12 (12 scan lines per millimeter). Reviewers used color-curve sets to adjust the tonal values while preserving the highlights and darkest shadow values. For the compositing section of this test, the final image build was pasted into a graduated mask, where light sources were adjusted to achieve realism in the image.

For our **Image Painting** test, reviewers painted flowers into a still-life Photo CD image of a drinking glass (see image at right). This test included customizing pens and brushes as well as color palettes. To help simulate realism, reviewers were instructed to use transparency-defined brush strokes—if possible—for the portions of the stem inside and outside the glass. They also had to build a brush tool using randomly blended color values to simulate textured paint for the flowers. They had to find the right combination of paint spacing, frequency, and edge diffusion to simulate the water in the glass, as well as the light reflecting off it.

Test Image 2

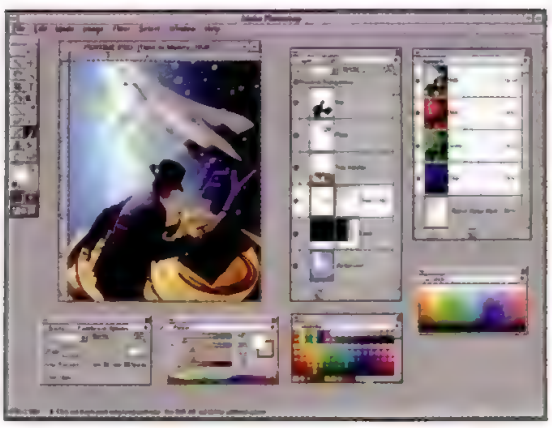
with each layer (you can have one transparency mask per layer). The layer masks work much in the same way traditional Photoshop masks do and are are just as easy to implement. The Layers palette kept track of each layer (and mask) by name and thumbnail. It also provided immediate access to the many commands that can affect layers such as Transparency/Opacity and Merge Layers.

CONTROL

In our tests, we defined several irregularly shaped layers. As we brought the layers into the composite, we could see each one's Transparency Mask—an empty area that has its transparency definition maintained in an alpha channel. This feature is a good way to control the composition; you can keep the transparency to apply changes to the layer, or choose to undo it to edit the selection.

Layers and masks remain intact only when an image is saved in Photoshop 3.0 file format (.PSD). Nonetheless, transparency information can be saved as an alpha channel tag in TIFF format. In addition, Photoshop's PC file formats can be saved or read to a Mac running Photoshop, and vice versa.

In this new version of Photoshop, Adobe has redesigned the package's palettes (which let you access such options as brush size, color, channels, and paths). Using the now-popular—and nearly standard—tabbed notebook metaphor, all the palettes can be stacked together or separated and spread around your screen. Much versatility has been built into the palettes. In the Brush Options palette, for instance, you see all the variables associated with the currently selected brush. You can quickly change any factor such as transparency, mode, wet edges, and fade parameters using one-step editing on the floating palette.



Photoshop 3.0's new palettes let you keep quite a bit of information and options up on the screen. Each of these palettes can be nested within each other using the popular tabbed notebook metaphor.

Previous versions of Photoshop forced you to bring up an entire file to edit a small portion of an image. Photoshop 3.0 has a new time-saving command, Quick Edit, that opens just a portion of a picture to be edited, and then saves it back into the file seamlessly.

FILTERS AND COLOR TOOLS

Photoshop has added new filters and improved the existing ones, adding a useful preview option for many of the single-pass filters. Among the new filters is Lighting Effects, a complex but powerful tool that emulates real world photographic lighting. Another new filter, Dust and Scratches, does an adequate job of removing those imperfections from photographs.

Photoshop 3.0 has some useful new tools among its already extensive color commands. The Color Range tool creates alpha channel selections based on colors using an eyedropper tool. In our tests, we were able to create a selection in a skyline picture that captured the blue sky and nothing else. Color Replace goes a step further, letting you generate the mask and adjust the hue, saturation, and brightness of the selected colors.

Professionals who depend upon Pho-

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SUMMARY OF FEATURES

Photo Illustration

Products listed in alphabetical order
■ = YES □ = NO

	Adobe Photoshop 3.0 for Windows	Fauve Matisse 1.26	Fractal Design Painter 2.0 with PainterX2	Image-In Professional Pack 3.20	PhotoPaint 5 Plus	Picture Publisher 5.0 for Windows
	PC MAGAZINE EDITORS' CHOICE		PC MAGAZINE EDITORS' CHOICE			
	$895	$149	$548	$399	CD-ROM, $199; CD-ROM and floppy disk, $249	$595
General Features						
File interchange (reads/writes)						
BMP	■■	■■	■■	■■	■■	■■
EPS	■■	□■	■■	□■	■■	□■
GIF	■□	■■	□□	■■	■■	■■
IFF	■■	□□	□□	□□	□□	□□
JPEG	■■	■■	□□	■■	■■	■■
Kodak Photo CD (reads only)	■	■	□	■	■	■
Macintosh formats	■■	□□	■■	■■	■□	■□
PCX	■■	■■	■■	■■	■■	■■
Scitex CT	■■	□□	□□	□□	■■	■■
TIFF formats						
TIFF	■■	■■	■■	■■	■■	■■
TIFF, Revision 6	■■	■■	□□	□□	■■	■□
TIFF with alpha channels	■■	□□	■■	□□	■■	□□
CMYK TIFF	■■	□□	□■	□■	■■	■■
Painting Tools						
Airbrush/Chalk/Charcoal	■□□	■■■	■■■	■□□	■□■	■■□
Crayons/Felt-tip pens	□□	■■	■■	□□	□■	■■
Oil brushes/Watercolor brushes	□□	■■	■■	□■	■□	■■
Pen and ink/Pencils/Calligraphic lines	□■□	■■■	■■■	■■□	■□■	□■■
User can blend/smudge images	■■	■■	■■	■■	■■	■■
User can edit brush shape/save brush	■■	■■	■■	■□	■■	■■
User can specify pressure/thickness of media	■■	■■	■■	■■	■■	■■
Number of patterns/textures	21, 75	20, 20	None, 72	None, none	415, 100	None, 3
User can specify transparency/rate of flow	■■	■□	■■	■■	■■	■■
Linear/radial gradient fills	■■	■■	■□	■■	■■	■■
User can choose angle/center	■■	■■	■□	■■	■■	■■
Arcs/Circles/Ellipses	□■■	■■■	□□□	■■■	□■■	■■■
Freehand/Bezier/spline curves	■■□	■■□	□□□	■■□	■■□	■■■
Polylines/Polygons	■■	■■	■■	■■	■■	■■
Image Processing						
User can blur/soften/sharpen images	■■■	■■■	■■■	■■■	■■■	■■■
User can edit in RGB/CMYK mode	■■	■□	■□	■■	■■	■■
Color balance/Gray balance	■■	■■	□□	■■	□■	■■
User can select/edit highlights, midtones, and shadows	■■	■■	□□	■■	□□	■■
Dithering/Equalizing/Anti-aliasing	■■■	■■■	■■■	■■■	■■■	■■■
Histogram tool	■	■	■	■	■	■
User can adjust hue/saturation	■■	■■	■■	■■	■■	■■
Supports CMYK/HSV/RGB palettes	■■■	■■■	□■□	■■■	■■■	■■■
User can edit with color-picker	■	□	■	■	■	■
Image Editing						
Alpha-channel support	■	■	■	□	■	■
Multiple channels	■	□	□	□	■	■
User can split into/combine/edit channels	■■■	□□□	□□□	□□□	■■■	■■■
User can save masks as such/as alpha channels	■■	■□	■□	■□	■■	■■
User can crop/duplicate bitmapped selections	■■	■■	□■	■■	■■	■■
Magic wand selection tool	■	■	■	■	■	■
Gaussian/motion/radial blur filters	■■■	■■■	■■□	□■□	■■□	■■□
Displace/pinch/ripple distort filters	■■■	□■■	■□□	□□■	□■■	□■□
User can despeckle/add noise	■■	■■	□□	■■	■■	■■
User can detect/enhance edges	■■	■□	■■	■■	■■	■■
User can emboss/smooth images	■■	■■	■□	■■	■■	■■
User can posterize/apply negative filters	■■	■■	■■	■■	■■	■■
User can combine images using masks	■	■	■	■	■	■
User can specify opacity of/anti-alias composite images	■■	■□	■■	■■	■■	■■
Supports third-party plug-ins	■	■	■	■	■	■
Text Handling						
Anti-aliasing	■	□	■			■
User can cut, copy, and paste as text	■	■	□	■	□	□
User can size/style/rotate text in real time (on canvas)	■■■	■□■	■■■		■□■	■■■
Input-Device Support						
Digitizer tablets/Pressure sensitivity	■■	■■	■■	■■	■■	■■
Supports frame-grabbers	■	□	□	□	■	□
Supports scanners through Twain	■	■	■	■	■	■
Supports still video cameras	■	□	□	□	■	□
User can calibrate input device	■	■	□	■	■	■
Output-Device Support						
User can independently specify CMYK channels	■	□	□	□	■	■
User can calibrate output device	■	□	□	■	■	■

toshop's prepress tools will welcome the addition of several new items. For example, a Gamut Warning tool shows what colors won't print correctly in a particular color mode; a CMYK Preview chooses alternative colors for the ones out of gamut; and a selective color correction feature controls ink amounts. Photoshop's new sponge tool removes saturation, which helps bring printable colors within the printable gamut.

SPEED AND POWER

Unlike Version 2.5, Photoshop 3.0 is a full 32-bit application, and as such, runs much faster. The same installation has an optimized version for both Windows and Windows NT 3.5, and provides symmetric multiprocessing under the latter (see the sidebar "Cross-Platform Tests"). The CD-ROM version of Photoshop includes Adobe Acrobat Reader, tutorials, stock photography, and sample digital art, as well as The Filter Factory—an applet for creating plug-in filters. The Filter Factory has a mini-programming language, involving formula input; an explanation of the language is provided.

SUITABILITY TO TASK

Adobe Photoshop 3.0 for Windows

	Power	Ease of Use
Image editing	EXCELLENT	GOOD
24-bit image painting	EXCELLENT	GOOD
Customization	EXCELLENT	EXCELLENT
Color support	EXCELLENT	EXCELLENT

With all that has been added, improved, speeded up, and jazzed up, Photoshop 3.0 may seem too complex at times. Luckily, Adobe has done the usual good job with intelligent and easy-to-follow tutorials. Actually, the features of Adobe Photoshop, Version 3.0, are so extensive and varied that even experts who use it daily probably won't unearth all the power in the program.

▶ **Adobe Photoshop, Version 3.0 for Windows.** List price: *$895.* Requires: *386-based PC or better, 10MB RAM (16MB for Windows NT), 20MB hard disk space, Microsoft Windows 3.1 or later or Windows NT 3.5.* Adobe Systems Inc., *1585 Charleston Rd., P.O. Box 7900, Mountain View, CA 94039-7900; , 800-833-6687, 415-961-4400; fax, 415-961-3769.*

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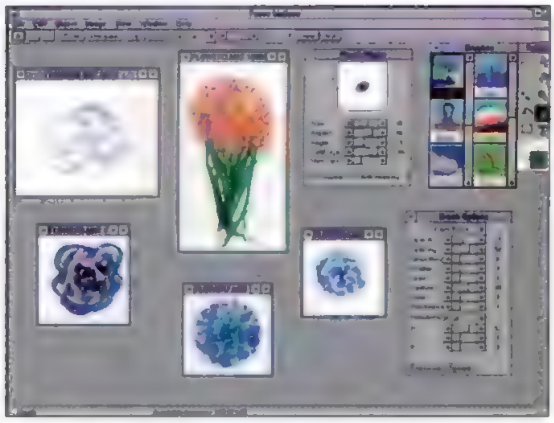
Fauve Software Inc.

• Fauve Matisse 1.26

BY SALLY WIENER GROTTA

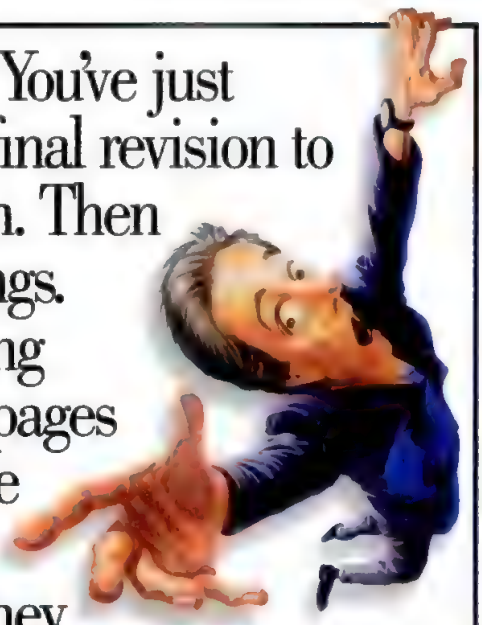
Fauve Matisse, Version 1.26 ($149), is an innovative, fun-to-use, and inexpensive natural media paint program that lacks the sophistication and depth of features that other, more expensive programs aimed at professionals have. It's really better suited for the hobbyist who wants to do something interesting with photographs and illustrations.

Fauve Matisse's strong suit is its library of 35 artistic brushes. You can choose from a variety of styles, including watercolor, charcoal, oil paint, calligraphic pen, and Pointillist. The ease with which the brushes can be customized belies their impressive power. Scroll bars in the Brush Options and Brush Shape palettes control a wide range of options that include shape, soft edge, scatter, transparency/opacity, angle, number of tips, color randomization, bleed, and texture sensitivity (based on a provided library of preset or user-defined textures). When you create a new definition or new parameters for a brush, you can permanently overwrite the current defaults with your new settings. You can't,



Fauve Matisse's greatest strengths are in its natural media emulation. You can achieve a wide variety of artistic effects by changing any or all of the brush options and shapes parameters or by choosing from 35 predefined brush styles.

It's 3:50 pm. You've just finished the final revision to the sales plan. Then the phone rings. "We're sending over 10 new pages of competitive info." Click. Good thing they lock the windows on this floor. You have to get it into the plan by the end of the day. What now?



SUITABILITY TO TASK

Fauve Matisse 1.26	Power	Ease of Use
Image editing	FAIR	FAIR
24-bit image painting	GOOD	GOOD
Customization	FAIR	GOOD
Color support	POOR	FAIR

however, save the settings as a new brush without overwriting the default settings.

PIECING IT TOGETHER

Fauve Matisse's compositing is done using object editing. In other words, everything pasted into a picture is defined as a separate and independent object, which may be re-edited at any time because each object isn't merged into the underlying pixels. Any of Fauve Matisse's floating selections may be designated as an object which can be dragged from one picture and dropped into another. Or the object may be cut or copied and pasted.

You can place each object into a picture using variable transparency/opacity, different apply modes (normal, blackness, lighter, darker or add), and the object's own mask, which Fauve calls an Opacity Layer. The process of creating and editing Fauve Matisse's masks is somewhat convoluted. When an object is active, selecting the Export Opacity Layer command generates a separate gray-scale image which is the same size as the object. This gray-scale picture is, in effect, the mask for that object. You can then edit that gray scale using any of Fauve Matisse's tools. The image/mask can then be imported back into the object's opacity layer. While the process sounds clunky, we found that because the mask was so accessible for editing and creating special effects, it gave us a high degree of control and versatility when creating our test composite image.

Unfortunately, Fauve Matisse's bitmap selection tools—the standard magic wand, lasso, rectangle, and ellipse—are clumsy. The vector-based shape tools are a little more flexible, and can be edited using a Bezier tool which is easily converted to a marquee. In our tests, however, we still found it nearly impossible to create a precise marquee when selecting the irregularly shaped objects in our test image. For example, we were unable to edit areas of the selection that were close to the initial outline. The product does have a feather command—called Object Soften Edges—but not a defringe command.

The major drawback to Fauve Matisse's object-layering scheme is its lack of an object palette to help keep track of and edit each object. Because everything is handled interactively with cursor clicks and drags, if an object is covered by another, the only (and time-consuming) way to edit the underlying object is to move the covering one. As with most image-editing programs that support layers or objects, saving an image with all object and mask information intact requires using Fauve's proprietary file format.

THE REAL THING?

A program designed primarily for amateurs, Fauve Matisse offers no color management and prepress tools. While those deliberate omissions are both understandable and acceptable, what is frustrating is Fauve Matisse's failure to fully implement its compositing and selection tools. Fauve promises that many of these deficiencies will be corrected in the next version, scheduled for release later this year.

Keep in mind that Fauve Matisse was never meant to compete head-on with high-end imaging programs. Fauve Matisse does deliver what it promises—an easy-to-use natural media emulator—especially where the power and versatility of its artistic brushes are concerned.

▶ **Fauve Matisse, Version 1.26.** List price: *$149.* Requires: *386-based PC or higher, DOS 3.1 (or later), Microsoft Windows 3.1, 4MB RAM, 4MB hard disk space.* Fauve Software Inc., *975 Walnut St.,#242, Cary, NC 27511; 800-898-2787; 919-380-9933; fax, 919-380-0110.*

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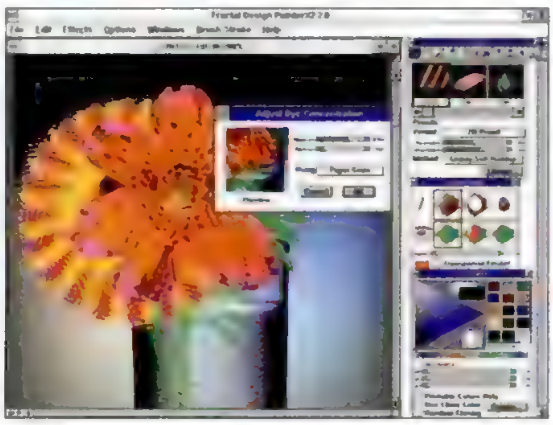


Fractal Design Painter's Adjust Dye Concentration feature lets you adjust color intensity by adjusting minimum and maximum values. In effect, you can darken the appearance of color and enhance the saturation of a given hue.

Fractal Design Corp.

EDITORS' CHOICE

Fractal Design Painter 2.0 with PainterX2

BY MARLA G. MILNE

Fractal Design Painter 2.0, the digital tool for simulating natural media effects such as oil, charcoal, and water, is not for the tentative, lazy, or sometime artist. In fact, it helps to be a little bit obsessive about trying out a multitude of variants and perfecting subtle fluctuations in texture, lighting, and blends. Painter provides a great deal of control over creating images, customizing brushes, and generating libraries of textures and different kinds of palettes. With the addition of PainterX2, Painter gains an object library and support for multiple floating selections.

Painter ($399) and PainterX2 ($149) provide many features, but to make the most of them, you'll want a powerful machine with a 24-bit color display. A pressure-sensitive drawing tablet and stylus are imperative for taking advantage of Painter's nuances of texture and style.

NATURAL EFFECTS

Painter includes 14 palettes, most of which offer some variety of paint options. The brushes palette provides access to pencils, chalk, charcoal, pens, airbrush, and crayons, and there are several varieties of each. For the pen tool, you can choose a calligraphy pen option, and for the charcoal tool, you can choose a gritty or soft effect. Another option lets you apply paint in the styles of Van Gogh or Seurat. With the water and liquid tools, you can effectively smear the paint on your page.

Painter lets you define the size of your

pen or brush tip, and from a palette of paper textures, you can choose, among others, cotton paper and fine-grain paper. The color palette uses the HSL (Hue, Saturation, and Luminance) color model, which lets you view and edit colors easily.

The program's intelligent enough to read the degree of pressure applied through your pen, the density of your paper texture, and the concentration of color you apply (called dye-concentration color-space mixing) to simulate the effect of natural media on paper. You can define and save your own variations on brush types and texture and color palettes.

Painter includes many different effects—transparency, blurring, and lighting—and you can define several variables for each. One of the lighting effects lets you specify ambient-light color and light-source color, and the blur effects include glass distortion and motion blurs. You can preview your image before you apply any effect.

SUITABILITY TO TASK

Fractal Design Painter 2.0 with PainterX2

	Power	Ease of Use
Image editing	GOOD	FAIR
24-bit image painting	EXCELLENT	GOOD
Customization	EXCELLENT	GOOD
Color support	GOOD	FAIR

MASKED IMAGES

In our Image Editing test, we had a difficult time creating selections or "friskets," as they are called in Painter. To create a frisket successfully, you need an image with a striking contrast between the selected section and the section you want to exclude; our test image did not quite meet that criterion. Also, the current version of Painter lacks support for Bezier curves, so we had a hard time defining the irregular image and curved image in our tests. We had to rely on the Magic Wand tool, which doesn't always allow for the accuracy that Bezier-curve selection gives you.

Furthermore, when we generated a mask by acquiring the values of a clone image source and activated a frisket, the mask that was thus generated overwrote the existing mask. On a more positive note, Painter's friskets have notably smooth edges, so we were able to assemble our composite image seamlessly.

Thanks mostly to PainterX2, it was easy to layer and position the many image elements for the image editing portion of our test. Just the same, PainterX2's masking is rather clumsy and limited. For example, there's no way to fill a mask directly with a gradation, cut-and-paste, 8-bit image data directly to a mask, or alter the tonal ranges of values within an existing mask. Most of these operations can, however, be performed on a selection—just without the control of a protected mask.

A BRIGHT FUTURE

A preview of Version 3.0 (due by the time you read this) reveals some major changes to Painter. The new version incorporates the PainterX2 floating selection technology, makes selections and masks one and the same, reduces the number of palettes from 14 to 7, and adds support for Bezier curves. There's also an automatic drop-shadow tool for casting realistic shadows; each shadow is given its own mask. Also, the new release introduces some useful techniques for creating animation and rotoscoping live footage. Finally, an outrageous new feature called Image Hose lets you spray image elements from a user-defined library of image objects.

In image-editing tasks, Painter and PainterX2 fall short of the mark at times. But artists who demand a great deal of control over a variety of paint tools and effects will feel right at home with the paradigm presented by Fractal Design.

▶ **Fractal Design Painter 2.0 with PainterX2.** List price: *$548.* Requires: *4MB RAM (8MB RAM recommended), 10MB hard disk space.* Fractal Design Corp., *335 Spreckels Dr., Aptos, CA 95003; 800-647-7443, 408-688-8800; fax, 408-688-8836.*

Circle 483 on your reader service card

CPI Inc.

● Image-In Professional Pack 3.20

BY GAYLE C. EHRENMAN

Image-In Professional Pack, Version 3.20, is a product with an identity crisis. It lacks the fine artistic controls and power-image

editing that professionals require, but it's not automated enough to be a good fit for business users. What it is, then, is a reasonably priced package in search of a market.

For $399, Image-In (in its "Pack" form) provides what would seem to be a one-stop solution for scanning and manipulating images and documents. Would that it were so simple. The bundle includes Image-In ScanAssist, an automated scan utility; Image-In Read, an OCR utility for scanned documents; Image-In Color Professional, the photo manipulation module; Image-In Copier, a utility for creating digital photocopies of documents; Agfa FotoTune LE, a color management system; and Image-In Vect, a raster-to-vector conversion program.

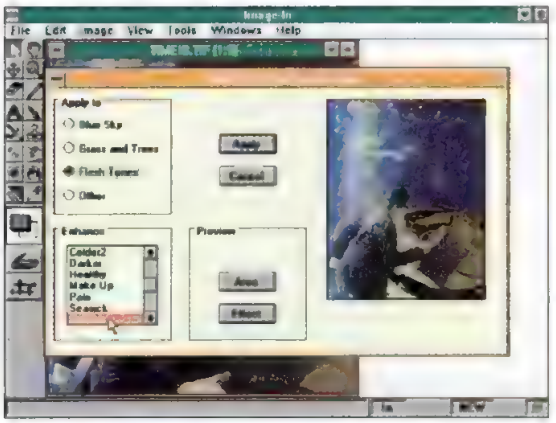


Image-In's SpectaColor filters allow you to enhance the color of a specific aspect of an image. Here, we can give a suntan to an otherwise pale businessman.

While this is certainly a diverse series of offerings, not all of the modules are as useful as they could be. For example, Image-In Vect only works with black-and-white images. While the Agfa FotoTune LE module provides color management capabilities missing from Image-In Color Professional, it includes a limited number of device-specific ColorLinks. So whether or not you'll be able to benefit from the color correction capabilities of this system is a hit-or-miss proposition.

DOWN TO BUSINESS

At the core of the bundle lies the photo manipulation component, Image-In Color Professional, a program that seems little changed from the last time we reviewed it. This module offers a few niceties, but not enough control over them to warrant a *professional* label. For starters, the program does not offer the sophisticated masking capabilities of the other professional level packages in this review; there's very limited support for alpha channel masks, and no support for free-floating objects or multiple selections. Instead, you have a series of selection tools with some useful, if not powerful, options. For example, you can create new selections and then fine-tune them by adding or subtracting from the selected area. But you can't convert a mask selection to Bezier curves, so you can't node-edit it. As a result, it's tough to create precise masks.

Because of the limits of these selection tools, creating the tonal transparency masks required to merge the two watch files in our test image was an arduous process. We had to go through multiple routines that were not always obvious in a procedure that can take one or two steps in other packages. It's therefore hard to recommend Image-In for creating composite images.

RETOUCHING

For retouching and adjusting simple photos, Image-In fares somewhat better. It features all the standard cloning and painting tools, with the usual range of options, including the ability to set the spacing, pressure, fade-out, and paint mode. Transparency control is available for the airbrush and gradient fill tools, but not for the paintbrush. While you can adjust the paint and line tools, you can't save custom brushes or create any effects that mimic natural media painting. This made it difficult to create the realistic-looking flowers called for in our image creation test.

SUITABILITY TO TASK

Image-In Professional Pack 3.20

	Power	Ease of Use
Image editing	FAIR	POOR
24-bit image painting	FAIR	FAIR
Customization	POOR	FAIR
Color support	FAIR	FAIR

When it comes to filters, Image-In once again serves up a mixed bag. All the filters and Color Map adjustments you'd expect from a professional-level package are here, but while some give you adequate control, others are a little too automatic. For example, you cannot manually equalize an image. Instead, the program determines some degree of "optimal" equalization, and alters the image without even showing you a preview.

Other filters, such as the SpectaColor series, are better implemented. These filters let you choose what type of objects, such as grass or sky, should be adjusted in a photo, and then decide what sort of effect you'd like to apply. You can select Grass and Trees and then use the Summer Grass option to turn green grass yellowish. And unlike the Equalize option, this series of effects offers interactive previews.

Adding more of these automated effects and making the package easier to use would make Image-In a good choice for business users. Nothing short of a complete overhaul will make it competitive as a professional image-manipulation tool.

▶ **Image-In Professional Pack.** List price: *$399.* Requires: *386-based PC or better, 4MB RAM, 6MB hard disk space.* CPI Inc., *1953 Landings Dr., Mountain View, CA 94043; 800-345-3540, 415-961-6556; fax 415-961-6456.*

Circle 484 on reader service card.

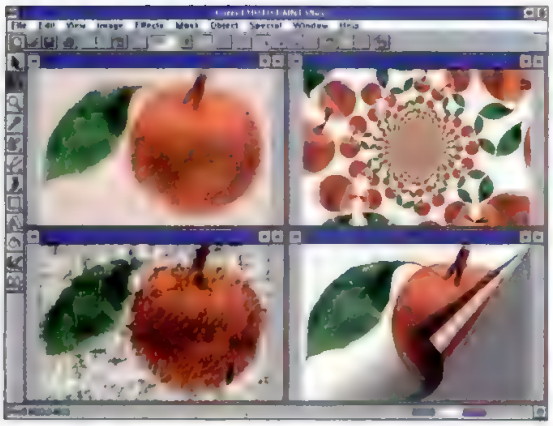
Corel Corp.

• PhotoPaint 5 Plus

BY DON LABRIOLA

It's been a long, strange trip for Corel's PhotoPaint. Originally cloned from ZSoft's PhotoFinish product and bundled into CorelDRAW 3.0, it was repeatedly overhauled until virtually no ZSoft code remained. Its latest incarnation is PhotoPaint 5 Plus ($199 on CD-ROM, $249 on floppy disk with CD-ROM included), a standalone version of the most recent CorelDRAW paint module that adds filters, third-party plug-ins, and clip media. The result is a package more suitable for mainstream users than publishing professionals; although it offers broad functionality for less than half the price of Photoshop or Picture Publisher, PhotoPaint doesn't quite match their flexibility, depth, or maturity.

At first, PhotoPaint looks a lot like



PhotoPaint's huge assortment of built-in filters and bundled plug-in modules provide over 130 types of special effects.

CorelDRAW 5. It features the same Microsoft Office-style button bar and Corel-style roll-up windows and toolbox. But that's where the similarity ends. PhotoPaint's floating objects each occupy a unique unnamed layer and can only be selected one at a time, making it impossible to group or align them. The program does provide CorelDRAW-style stretch, scale, rotate, and warp functions, but once a floating object is built, there's no way to trim it, add to it, or cut a hole from its interior.

New users may be confused by PhotoPaint's three types of masks. Regular masks work the way you'd expect, outlining areas to be edited or protected; color masks are similar, but affect only specific color ranges; and transparency masks are alpha-channel objects that you fill with gray-scale patterns to control the opacity of other graphics. Unfortunately, all three resemble floating objects, even though they serve distinct purposes and are manipulated with different, but confusingly similar, tools. In our tests, we found that the rules for creating and manipulating masks and objects were inconsistent, and we could not anti-alias or feather regular masks, or combine multiple floating objects.

PhotoPaint provides enough image-processing features such as Brightness, Contrast, and Hue/Saturation controls to please most business presenters. Still, it doesn't offer the precision of Photoshop's channel-specific tonal-curve editing tools.

Text-handling is also weak. Once we created a text object in our test image, it became a graphic element that could no longer be edited as text. Stretching and warping text produced rough-edged results despite a global anti-aliasing option.

PhotoPaint's disappointing natural-media brushes produced unconvincing results when used with a pressure-sensitive pen. Most frustrating, though, is the program's sluggish performance. Even with a 90-MHz Pentium, we found ourselves tapping our fingers when applying filters or painting with certain brushes.

COLORFUL SIDE

But despite all these complaints, PhotoPaint has a lot going for it. Excellent color-handling routines make it easy to create and manage palettes, and the program lets you work in a broad variety of color models, including 32-bit CMYK. You can also split an image into its component color channels, edit each plate independently, and then recombine them with just a few menu selections.

PhotoPaint's color-output module provides single-click control over trapping, registration marks, screening, color-plate choice, and dot gain. The program also offers a superior monitor/printer/scanner calibration function that includes gamut-mapping options tailored for colorimetric (spot color) or photographic work. PhotoPaint provides a terrific selection of object fills that includes tiled bitmaps, fountain fills, and 40 stunning programmable fractal textures. Other powerful features include a Restore Checkpoint function that undoes all your editing back to a previously-defined

SUITABILITY TO TASK

PhotoPaint 5 Plus	Power	Ease of Use
Image editing	GOOD	GOOD
24-bit image painting	GOOD	GOOD
Customization	GOOD	GOOD
Color support	GOOD	EXCELLENT

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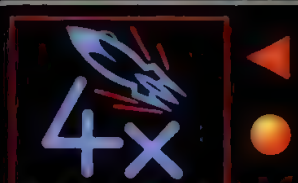

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checkpoint, and the ability to open and edit a small portion of a file.

PhotoPaint provides over 130 filters, including plug-in modules from HSC, Alien Skin Software, and (new to the Windows environment) Xaos Tools. PhotoPaint includes fonts, clip art, floating objects, and high-quality photographic images culled from the company's Professional Photos CD-ROM series.

PhotoPaint packs a lot of punch for the price, but it still has a few rough edges. It wasn't a contender for Editors' Choice, but one more overhaul may put it in the running.

▶ **PhotoPaint 5 Plus.** List price: CD, *$199; CD and floppy disk, $249.* Requires: *8MB RAM, 14MB hard disk space.* Corel Corp., *1600 Carling Ave., The Corel Bldg., Ottawa, Ontario, Canada K1Z 8R7; 800-772-6735, 613-728-8200, fax, 613-728-9176.*

Circle 484 on reader service card.

Micrografx Inc.

Picture Publisher 5.0 for Windows

BY MARLA G. MILNE

With the addition of a command list and improved mask creation, Micrografx is positioning the $595 Picture Publisher 5.0 for Windows as a serious contender in the professional photo illustration market. At the same time, the competitive upgrade offer of $99.95 (to continue indefinitely) indicates that the company may also be seeking a much broader user base—one that might even include the occasional user. As always, the reality lies somewhere in between. In our view, Picture Publisher is for people who want practical photo illustration capabilities within a productive environment.

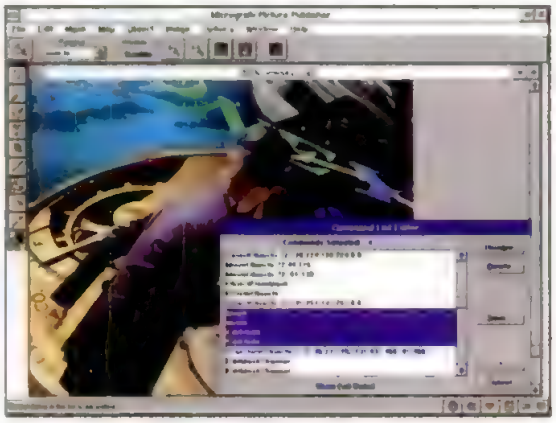
Picture Publisher encompasses a well-rounded suite of features for photo illustration. The package's greatest strength lies in its easy-to-learn interface and customizable tool boxes that include command sets, tools, and macros for redundant tasks. Its greatest weakness is the implementation of a single alpha channel for masking, and anti-aliasing techniques that seem to blur as much as they smooth. When layering silhouetted images over a background during testing, we had trouble creating a soft, clean edge without a fuzzy haze.

Picture Publisher's paint tools let us render high-quality textures, transparency, and smudginess with ease. We were pleased with how quickly we were able to complete the image-painting portion of our test in Picture Publisher.

Picture Publisher's greatest strengths are its easy-to-learn interface and customizable tool boxes. A notable weakness is an anti-aliasing technique that seems to blur as much as it smooths.

CLEARER PICTURE

Micrografx has done a good job of strengthening existing features in Picture Publisher. For example, the package has improved mask editing (the new version has true Bezier curves and splines) and expanded support for CMYK. You can open Scitex CT files and use color mapping controls on CMYK layers. As in the previous version, Picture Publisher features floating selections; you can still select multiple floating selections and perform simultaneous moves such as perspective or skew. In this regard, Picture Publisher outperforms Photoshop's layered approach. In addition, you can now group and align selections.



Picture Publisher's Command List feature lets you recreate an entire work session on an image at a higher resolution, use the same brushstrokes on two images, and change the order in which actions occur.

Unfortunately, Picture Publisher's rather graceful approach to object-and-layer management is hobbled by its support of only one alpha channel. In our test composite images, this resulted in the need to combine layers with the background image before continuing to complete the image.

Since Version 4.0, Picture Publisher has offered special features for opening and editing large image files, even if you don't have sufficient RAM. For example, the package's FastBits feature lets you edit one or more sections of a TIFF image, which can then be re-saved to the original image file. Also, you can resize an image to a lower resolution.

The most powerful addition to Picture Publisher is the Command List. Although it could be better designed, it's an impressive first step toward resolution-independent editing.

The Command List activates automatically whenever you create a new image file. It records all actions performed on an image, and is saved with it using Micrografx's native PP5 format. You can choose to undo or redo any step, stroke, or action just by clicking on the item in the command list. In effect, this provides the functionality of unlimited undo without the cost to memory. Any command list can be replayed or edited in the original file (as long as it's saved in Picture Publisher's native format), or better yet, in the original high-resolution image—hence, *resolution-independent* editing. For other file types (or files), you can save and replay the command list as a macro.

But as, inevitably, you perform many redundant actions in the course of editing an image, replaying the command list can take a significant amount of time. We tried to get around this by editing our command list and removing repetitive steps. Even though Picture Publisher will automatically condense repetitive undos, we still found this to be a complex task since many of the actions, such as Paint-

Brush "Solid," look identical, even with the "full detail" option turned on.

COMMANDS AND TOOLSETS

Even with the newly added features, Picture Publisher's interface has remained appealingly simple. We were able to create and save task-specific toolboxes that combined tools and commands that we used within a specific context.

SUITABILITY TO TASK

Picture Publisher 5.0 for Windows	Power	Ease of Use
Image editing	GOOD	EXCELLENT
24-bit image painting	GOOD	EXCELLENT
Customization	GOOD	EXCELLENT
Color support	GOOD	GOOD

Picture Publisher also offers an excellent set of color-mapping tools for the color management aspect of image editing. The package lets you edit the cyan, magenta, yellow, or black (CMYK) layers of separated images; you can also create a new CMYK-image file and import Scitex CT image scans. The process of color calibration for the scanner and output device is described in a simple step-by-step guide, but without a lot of color theory.

For those seeking more sophisticated profiles of color input or output devices, Micrografx offers Kodak's Color Management System. A printed Kodak brochure that ships with Picture Publisher features custom tables specifically designed to work with the package.

Picture Publisher offers a consistent and easy-to-learn interface, a wide range of paint styles with user-definable textures, and powerful custom toolboxes and command lists for productivity. Although it isn't for those who need to produce complex image assemblies with crisp, smooth edges that can compete with professional prepress work, Picture Publisher is well-suited for users with a high volume of images to edit, composite, or retouch. □

▶ **Picture Publisher 5.0 for Windows.** List price: *$595.* Requires: *4MB RAM (8MB recommended), 8MB hard disk space.* Micrografx Inc., *1303 Arapaho, Richardson, TX 75081; 800-733-3729, 214-234-1769; fax, 214-994-6289.*

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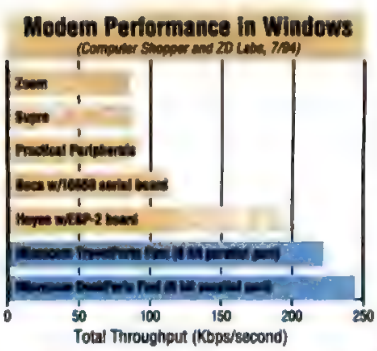
WHAT HAPPENS TO WINDOWS DATA WITH AN ORDINARY MODEM.

WHAT HAPPENS TO WINDOWS DATA WITH A MICROCOM MODEM.



The problem with ordinary modems is the serial port bottleneck. At high speeds, Windows data slams on the brakes as it tries to squeeze through your modem's ***serial port—which can only transfer data one bit at a time.*** Results: slower performance, frequent loss of data and higher phone charges.

A serial port accelerator card can help, but it can add $100 to the price and is difficult to install.

So Microcom got the bright idea of using the ***parallel port—which transfers data 8 bits at a time.*** And pioneered parallel port technology with a whole family of competitively-priced modems, including a high-speed PCMCIA card for notebook users.

Microcom's high-speed data/fax modems include the DeskPorte™, TravelCard™ and TravelPorte™ product lines.

As the ZD Labs chart clearly shows, this solution is a winner. In fact, the DeskPorte *FAST* 28.8 was "Experts' Pick" in the July '94 issue of *Windows Sources*. Both Microcom modems they tested achieved "...the highest overall throughput of any rival."

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CIRCLE 862 ON READER SERVICE CARD

PCMCIA CONNECTIVITY

SOCKET TO US

PCMCIA may be the acronym that everyone loves to hate, but these convenient little devices are making strides as reliable products that are worth the premium. Here we test some PCMCIA modems and LAN adapters. *By Steve Rigney*

The allure of credit card–size PCMCIA adapters was tainted by some early kinks in design. But those days will soon be relegated to pioneer memories. Most new notebook PCs come equipped with one, if not two, slots for PCMCIA cards. But increasingly, people aren't trying to duck it. As the early problems associated with it are worked out, PCMCIA is becoming more appealing.

Today, PCMCIA cards exhibit performance and reliability that approach or match that of standard-size adapters. The design complexity of PCMCIA technology may keep prices higher for longer, but the portability is worth the premium you pay in dollars, RAM, and battery life. Add to this the ever-multiplying variety and number of PCMCIA cards and vendors, and you've got a flourishing market growing as steadily as the notebook PC market it piggybacks.

In this article, we test a sampling of two of the most popular types of PCMCIA cards—modems and LAN adapters. We also take a quick look at some other PCMCIA devices, such as disk drives and sound cards.

A MOTTLED HISTORY

Who remembers that PCMCIA stands for Personal Computer Memory Card International Association and that it started out in 1989 to define a standard for credit card–size memory cards? Perhaps the mouthful of an acronym—in an industry that delights in its all-caps monikers—was a bad omen.

PCMCIA's problems have included incompatible software, excessive system memory requirements, and hardware design flaws. Fortunately, the PCMCIA has addressed some of the technical problems in a new standard. The group has even announced a new name to signal the im-

Photographs by Geoffrey Nelson

provements. The PCMCIA now calls the devices *PC Cards*. The acronym "PCMCIA" remains as the name of the organization that defines the standard.

The PCMCIA standard requires that all PC Cards be the same length and width (85.6 mm by 54 mm) and that they connect in the slot through a 68-pin connector. Beyond that, PCMCIA defines three types of PC Cards.

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Type I cards are limited to a thickness of 3.3 mm and are used principally as memory cards, including RAM, ROM, and DRAM. Type II PC Cards can be up to 5.5 mm thick. These cards are large enough to include I/O-port connections. Most LAN adapters and modems are Type II. Type III cards can be up to 10.5 mm thick. This type covers products that require moving parts—such as hard disks. PCMCIA slots are backward-compatible only for size; that is, your Type III slot will accept Type I and Type II cards, but your Type I slot will take only Type I cards.

The physical and electrical standards for PC Cards are evolving. The PCMCIA 1.0 standard defined only Type I cards but did not define an I/O feature or software drivers. PCMCIA 2.0 introduced I/O-specific cards but left software driver specifications up to the card manufacturers.

PCMCIA 2.1 introduced the use of software drivers called Card Services and Socket Services that helped solve many of the compatibility problems between different cards and slots (see the sidebar "Software Plays Catch-Up"). PCMCIA 2.1 is the most popular specification; all of the PC Cards we tested conform to it. This standard also introduced plug-and-play features, such as the ability to hot-swap the cards without rebooting your PC.

The PCMCIA recently decided to stop using version numbers to differentiate the standards—thus, the newest version refers simply to the *PC Card Standard*. The standard includes new specifications for 32-bit bus-mastering adapters, on-board DMA, multifunction adapters, and a reduced power requirement of 3.3 volts.

Although PCMCIA members have formally adopted the new standard, most PC Cards on the market still support only the PCMCIA 2.*x* or earlier standards. As we went to print, no adapters fully met the new standard.

HARD TIMES

The major gripes you hear about PC Cards focus on excessive memory and power requirements, heat problems, incompatible hardware and software, faulty connectors, and the lack of successful hot-swap features. The ideal for PC Cards is the new favorite catch-all phrase, plug-and-play.

When people think of plug-and-play, they envision a product that automatically configures and initializes itself when they plug it in. In real life, you must still install the card, then run configuration software that makes changes to your startup programs to make things work properly. None of this is rightly plug-and-play, but this should change eventually.

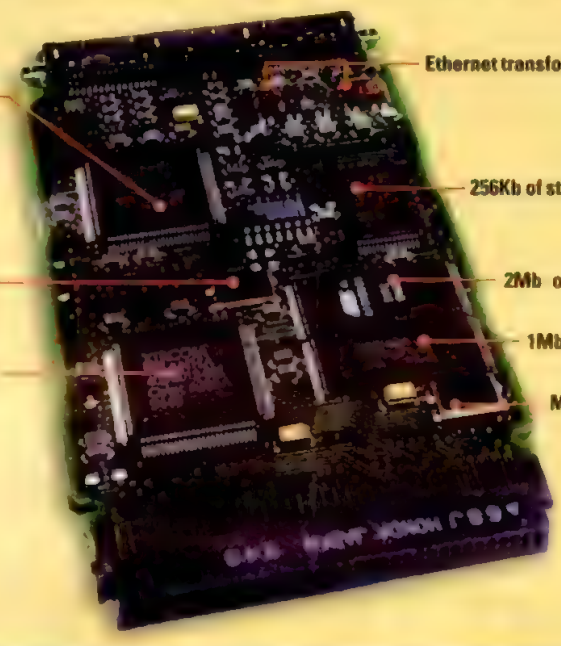
Most PC Cards also require that you specify a system interrupt, I/O address, and memory space. For example, most of these cards use the area of memory between D000 and DFFF. If you currently have a peripheral using that address, you'll have to change your configuration for the adapters to coexist. Deciding which interrupts, I/O, and memory addresses your system uses is not an easy task even for experienced installers.

After you resolve any hardware conflicts, you still must deal with the memory requirements. The PC Card Services and Socket Services can consume as much as 60K of RAM for each card. If you have multiple slots with PC Cards in each, you'll face a tough challenge saving RAM to run your DOS-based applications.

One solution to this problem comes

Inside a Multipurpose

Looking at the internals of Xircom's CreditCard Ethernet +Modem II reveals the intricacies of squeezing all that function-



HIGHLIGHTS

PCMCIA

EVERYBODY WANTS TO BE a fan of PCMCIA. It's been tough, though, with the compatibility and memory problems PCMCIA has had as it settles into a mature standard. Launched principally to specify credit card–size memory additions for notebook PCs, PCMCIA has become a delivery vehicle for all kinds of PC peripherals, including modems, LAN adapters, sound cards, and hard disks.

PC CARDS IS THE NEW NAME for PCMCIA cards. The PCMCIA group members decided on the new name to signal improvements in software compatibility, memory management, power consumption, and performance that it introduced with a new version of the standard. The new standard moves the spec toward the goal of plug-and-play functionality.

PORTABILITY, OR CONVENIENCE—whatever you call it—remains the principal appeal of PCMCIA. The complexity of the technology will keep the prices for these peripherals higher than their standard counterparts for a long time. In many cases, the convenience will probably be worth the premium that you'll pay in dollars, RAM, and battery life.

PERFORMANCE IS GOOD. Our testing of a sample group of PCMCIA modems and LAN adapters shows no significant difference between the performance of these products and their standard-size counterparts. And PCMCIA cards are now beginning to find their way onto desktops.

in the form of the multifunction cards defined in the new standard. Future PC Cards will offer as many as eight different "devices" on a single card. You could have a single PC Card that functions as a sound card, a network adapter, and a modem. These products will share addresses and memory.

SMALL, SMALLER, SMALLEST

In addition to notebook PCs, many subnotebooks and PDAs also have PC Card slots, but these carry a potential drawback. Because of their size, PDAs in particular do not offer a lot of battery power. Most PC Cards currently require 5 volts, and according to some anecdotal testing we did, they typically show a current drain of about 160 milliamps when in use. This is roughly 20 to 30 percent of the total drain for a notebook PC, and would be even more for a PDA.

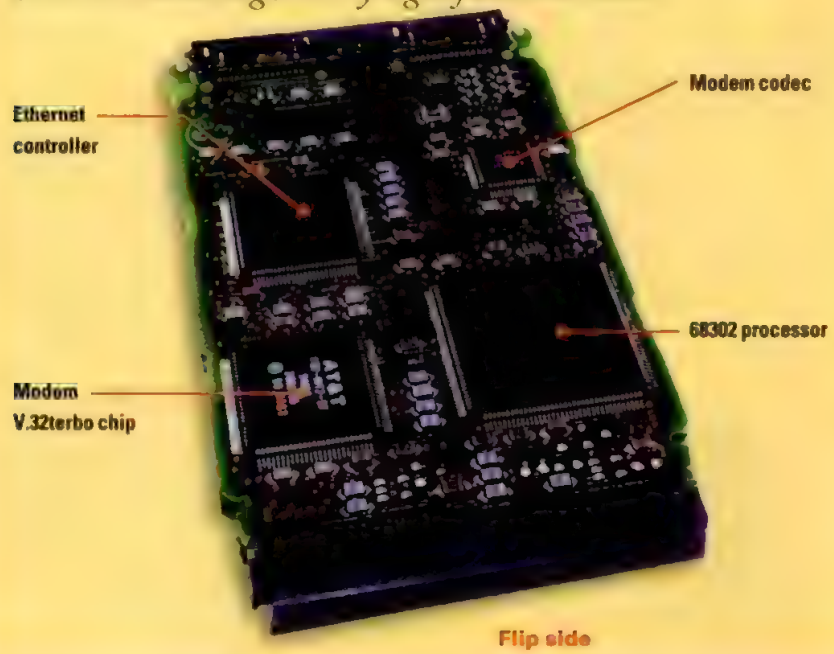
So if, for example, you frequently use your PC Card modem to send and receive large files, it will shorten the available battery life of your notebook or PDA. Although the new standard calls for adapters to use only 3.3 volts and less power overall, some PC Card vendors may continue to market 5-volt cards. It's something to be aware of.

Another area of differentiation is the variation among connectors that vendors offer on PC Cards. The principal complaints about connectors have been either that they are too fragile or that they are too large and cumbersome. Some vendors, Megahertz for example, integrate the connectors on the card, while others, such as Microcom, use an external cable and connector (which you could lose). Some companies patent their connectors. The PC Card Standard does not provide a specification for the external connector. You're still on your own to choose a good combination of sturdy design and ease of use.

Performance, interestingly, has not been a problem. As evidenced by the modems and LAN adapters we tested, PC Cards provide about the same performance, in terms of throughput, as equivalent ISA modems or LAN adapters. The PCMCIA 2.*x* standard requires only that

PCMCIA Card

ality onto one small card. This is only the beginning. Future PCMCIA cards might carry eight functions each.



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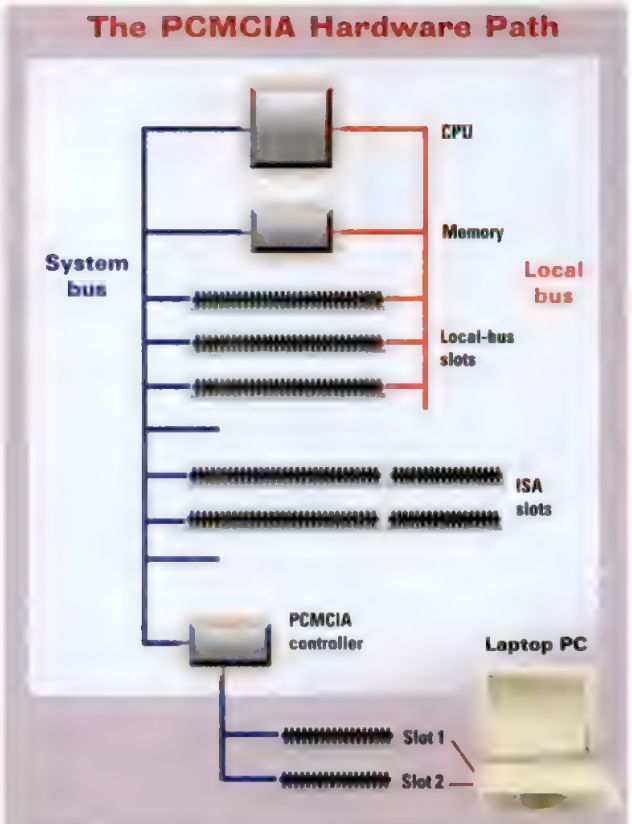

The PCMCIA controller moderates communications between a PC's system bus and the card slots; it converts the data signal on the system bus to signals that the cards can work with. This includes performing any address-translation magic on both memory and I/O addresses to make things work. Furthermore, the controller lets the Socket Services software automatically recognize a card and configure its options.

the adapters have access to a 16-bit data path delivered at a top speed of 6 MHz.

In addition, most PC Card modems contain a 16550 UART or a 16550 mimic that performs the same tasks. This gives you a better serial-port interface than the one installed in most notebook PCs and helps avoid the data bottleneck problems that you might otherwise face with a fast external modem.

NEW AVENUES FOR PCMCIA

Probably the most exciting development for PC Cards is their ability to be used on your desktop PC. Some PCs, such as the IBM PC 300 series, include PC Card slots. But you can also purchase a PC Card slot and adapter (from companies such as ACMA Computers and Curtis) that enable you to use PC Cards on any desktop PC. This is a plus. Being able to use the same kind of modem or other adapter on both desktop and notebook PCs helps justify the cost.

Another PC Card device makes it possible to hook up standard peripherals through your PCMCIA slot. Vendors such as American Megatrends and AST Research offer SCSI-port PC Cards that let you connect a CD-ROM or other SCSI device to your mobile PC. Other more exotic types of PC Cards are available as well (see the sidebars "At the PCMCIA Vanguard" and "Reach for the Stars").

One interesting new device that takes advantage of PCMCIA technology is the $3,299 Megahertz MobileLAN, a network remote access server that has eight PC Card slots. It accepts any Type II modems—not just those from Megahertz. It's a good solution if you're really out of space in your computer room and can therefore justify the extra expense of the PC Card modems for that purpose.

CRYSTAL CARD

How will PC Cards move forward from here? Some of the groundwork is laid in the PC Card Standard's 32-bit bus-mastering adapter called the CardBus. The new CardBus adapters will operate generally at speeds of 20 MHz with a top speed of 33 MHz. The CardBus adapters will offer approximately the same performance as devices designed for the PCI or EISA bus.

To further increase the performance and features of the new PC Cards, the standard allows card manufacturers to include a DMA channel on the cards. This will allow the vendors to offer new types of PC Cards, including sound cards and faster network adapters.

Another factor that will contribute to the proliferation of PC Cards is the upcoming release of Microsoft Windows 95. Like IBM's OS/2 Warp, Version 3, Windows 95 will include Card Services. Microsoft is officially calling this feature "Plug and Play." Its intent is to allow you to install a PC Card and have the operating system automatically detect, configure, and initialize it.

All of this sounds great. But the single biggest challenge for designers of PCMCIA products is to provide simple and reliable operation regardless of the type of device installed as a PC Card. Currently, different types of peripherals have specific methods of connecting and communicating with the PC. It is very difficult to provide true plug-and-play functionality without some manual configuration.

PCMCIA slots are beginning to show up on new desktop systems. And you can buy slots and adapters for virtually any PC.

In just one year we've seen significant changes in the PC Card spec and in the products that support it. The new PC Card Standard promises both to increase the variety of PC Cards that will be offered and to enhance their performance. The old adage proves true: Good things really do come in small packages.

Our Contributors: STEVE RIGNEY is a network consultant and a contributing editor to *PC Magazine*. STEPHEN SATCHELL owns Satchell Evaluations, a consulting firm that has been testing modems since 1984. H.B.J. CLIFFORD edits a monthly newsletter for the telecommunications industry. FRANK J. DERFLER, JR., is senior networking editor of *PC Magazine*. GAIL SHAFFER was the associate editor in charge of this story, and ROBERT P. LIPSCHUTZ was the project leader.

Software Plays Catch-Up

By Steve Rigney

PCMCIA cards have been plagued with problems since they first appeared on the market in 1990. The complaints have focused on both hardware hangups, such as faulty connectors, and software snags, such as driver compatibility problems and excessive memory requirements.

But while users may never agree on the best design for a common modem connector, the software problems *are* beginning to disappear, if only slowly. PCMCIA cards even have a new name to help signal the improvements. Now called *PC Cards* by the PCMCIA, the organization that produces the specification, they also now require two sets of software drivers called Card Services and Socket Services.

Card Services and Socket Services ease compatibility problems that have plagued PC Cards in the past.

This is an important development considering the cards debuted with no software support. Release 1.0 of the PCMCIA spec defined only memory cards, such as flash, DRAM, and ROM. You didn't need driver software to use these cards in your notebook. Release 2.0 introduced an I/O spec, but the PCMCIA still didn't define a software standard. If you bought a PCMCIA 2.0 modem or network adapter, you had to use proprietary software provided by the hardware vendor.

Early PCMCIA 2.0 cards used a software "enabler" that allowed an application to communicate with PCMCIA hardware. Unfortunately, every enabler was specific to the hardware, which made it nearly impossible to have multiple PC Cards in the same PC. This is not to mention the memory requirements it took to load multiple PC Cards and software enablers. Not until 1993, when the association released the PCMCIA 2.1 specification, did we finally see software support in the form of Card Services and Socket Services.

BELOW THE SLICK SURFACE

Socket Services is the lowest layer in the multilayer architecture that manages PC Cards. Socket Services provides a BIOS-level software interface to the hardware and controls the sockets for the PC Cards. These services hide the hardware details and allow higher-level software to control and use the cards without knowing the actual card interface.

For example, Socket Services enable a PCMCIA modem to appear as any other internal or external modem attached to your serial port. The Socket Services also automatically determine both when you insert or remove a PC Card and the type of card it is. The Socket Services make the PCMCIA cards appear as a standard-bus card.

The PCMCIA Card Services reside on top of the Socket Services layer and provide your application with access to the cards and sockets. Card Services also control PC Cards' use of system interrupts, memory, and, in some cases, power management. Whenever an application needs to access a PC Card, it goes through the Card Services and never has to directly communicate with the hardware or the Socket Services.

When you use a PCMCIA modem, for example, the Card Services determine the communications port a PC Card is using and which interrupts or I/O addresses are in use. The communications application does not know what type of modem you are *using*, only that it is connected to a specific communications port.

The Card Services are tied directly to the operating system you're using. Although most notebook and PC Card vendors provide card drivers for MS-DOS, IBM's OS/2, Version 2.1, and PC-DOS, Version 6.1, are currently the only operating systems that have Card Services bundled with them. Microsoft will include Card Services in Windows 95. As more vendors join IBM and Microsoft in providing integrated Card Services, the appeal and demand for PC Cards likely will increase.

Card Services and Socket Services are usually installed in your PC in the form of device drivers that are loaded in your CONFIG.SYS file. In testing PC Cards, one of the biggest complaints with Card Services and Socket Services, besides compatibility issues, is the amount of RAM they require. On a Toshiba 1950 notebook with a Microcom TravelCard Fast 28.8 modem for example, the Services required about 60KB of RAM. After we added our network drivers to the list, we barely had enough memory to run any large DOS-based application. Fortunately, you can load the drivers into upper memory, if you have any available.

Every PCMCIA-equipped notebook or PDA will include Card Services and Socket Services from companies such as Award Software, Phoenix, SystemSoft, or Ventura Microsystems. To make matters more confusing, your PCMCIA card may include a totally different set of Services. Although the PCMCIA provides specs for Card Services and Socket Services, there is no guarantee that all cards and sockets will be compatible. It depends on how vendors interpret the standard.

The new *PC Card Standard*, will help solve some of the compatibility problems but you will still need to make sure with the company that the PCMCIA card you want to buy works with your PC. □

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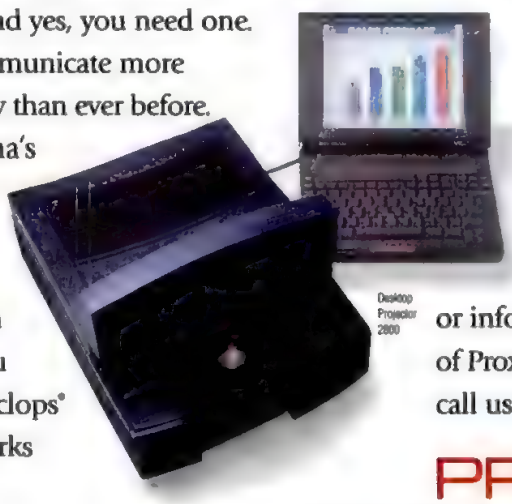

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PCMCIA MODEMS

AT EASE AMONG STANDARD-BEARERS

By Stephen Satchell

Like virtually all PC peripherals, PCMCIA modems have become faster, more reliable, and better priced than they were when first introduced. In short, they're an easier purchase decision to make. The products we tested here are five early-bird 28.8-Kbps modems and five mature 14.4-Kbps modems. Their performance was comparable with the 28.8-Kbps and 14.4-Kbps external modems tested in our most recent comprehensive roundups.

If you're a serious user whose professional livelihood could depend on your choice of a PCMCIA modem, you'll have to consider things other than price. The 14.4-Kbps PCMCIA modems list in the $250-to-$350 range and the 28.8-Kbps PCMCIA modems run about $500. That's not much more than their external counterparts—even some of the smaller pocket modems. And the pocket modems, such as those from Megahertz Corp., Practical Peripherals, and Xircom, don't have the size constraints (and therefore the controller horsepower constraints) of the credit card–size devices.

For mobile users, the most important factor is the modem's ability to make a connection regardless of the line. Convenience, particularly in the form of connection cables, also plays a significant part: Careful consideration here can prevent enormous frustration on the road later. Apart from network coverage, the exact performance parameters that you'll need to weigh depend on whether you use mail automation, remote-to-LAN software, or file-transfer software.

A SOLID SAMPLING

Although the V.34 protocol is the current leading edge in 28.8-Kbps telecommunications technology, when this article was written no PCMCIA modems had yet incorporated it. (For that matter, V.34 desktop modems themselves were still relatively rare.) Consequently, the 28.8-Kbps modems we tested all use the older Rockwell V.FC-only chip sets. However, almost all of the modem makers represented here are preparing V.34 upgrades.

We included 14.4-Kbps PCMCIA modems in this collection because many users aren't yet in a position to handle 28.8-Kbps transmissions. Commercial e-mail services and modem gateways for on-line systems have always been reluctant to upgrade their hardware; in many parts of the country, they will be limited to 9.6- or 14.4-Kbps transmission rates for the foreseeable future.

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CIRCLE 211 ON READER SERVICE CARD

What the Numbers Mean

Our comparison of samplings of PCMCIA V.FC and V.32bis modems shows that they perform just as well as their external counterparts. You pay no performance penalty for convenience.

We tested a sample group of PCMCIA modems to get a sense of their performance against their standard external counterparts. With few exceptions, both the 28.8-Kbps V.FC and 14.4-Kbps V.32bis PCMCIA modems performed similarly to their external cousins (most recently tested in "Hurry Up & Wait," September 13, 1994, and "Life in the Fast Lane," June 29, 1993).

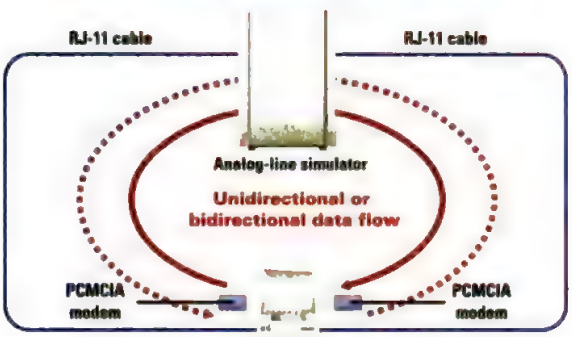
These units performed well across the board in unidirectional testing, but three—two 28.8-Kbps modems and one 14.4-Kbps modem—were unable to complete the bidirectional data transfers (except with the noncompressible file), because of data-mismatch errors. This usually indicates an overmatched modem processor. We suspect that heat generation from the PCMCIA cards themselves could have affected their on-board processors.

The two Microcom models and the TDK Systems DF2814 performed equally well in bidirectional testing—not surprising since they all use the same internal hardware, which TDK and Microcom codeveloped. More noteworthy was the Practical Peripherals ProClass PCMCIA 144, which was faster than the PreMax FM288 in unidirectional testing of a highly compressible graphics file. This was probably attributable to Practical Peripherals' outstanding V.42bis compression algorithm.

On the Telephone Network Simulation test, all of the 28.8-Kbps PCMCIA modems did nearly as well as the external 28.8-Kbps models we tested in our last roundup. One exception was the Apex Data V.Fast Data/Fax Modem, which posted a poor score. Even so, the Apex modem still performed better than any of the 14.4-Kbps modems. We found no significant scoring differences among the 14.4-Kbps modems.

—Analysis written by Tim Crawford

PCMCIA Modem Test-Bed



Dell 486/33 ME with SCM PCMCIA-to-ISA adapter

How We Tested

Our test procedures are derived from the *EIA/TIA Telecommunications Systems Bulletin 38*. The modem test suite evaluates modem hardware only, focusing on line interface, V.42bis compression, and V.42 error correction. In our test-bed we used a Telecom Analysis Systems (TAS) Model 240 Voiceband Subscriber Loop Emulator together with a TAS Series II Telephone Network Emulator. The combined unit was attached to a Dell 486/33 ME PC, which contained an SCM Microsystems PCMCIA-to-ISA adapter. The

HIGHLY COMPRESSIBLE GRAPHICS FILE

N/A—Not applicable. The product could not perform this test.

MODERATELY COMPRESSIBLE TEXT FILE

N/A—Not applicable. The product could not perform this test.

PCMCIA modems were inserted into the adapter during testing.

The test software—XFR, developed by Satchell Evaluations—sends data through one of the PCMCIA ports either unidirectionally or bidirectionally and records the throughput rate as data is received at the other PCMCIA port. The program also checks the integrity of the received data against the sent data.

We asked each vendor to provide information enabling us to create an initialization string that would make each modem perform at its highest potential. Our tests involve the transfer of data between two identical modems from each vendor.

Our file throughput tests measure each modem's performance as it transmits files representing five different data types. Each of the files is 32K to remove overhead caused by disk activity, and we load all of them into memory before running the tests. We configure the TAS units for minimal line impairments.

We send each file from one modem to another, retransmitting the file until 1 million bits have passed through the first modem's signal converter, and then measure the unidirectional throughput. We then repeat the procedure, transmitting copies of the file in both directions at once; our bidirectional throughput scores reflect the amount of data flowing in one direction during this process.

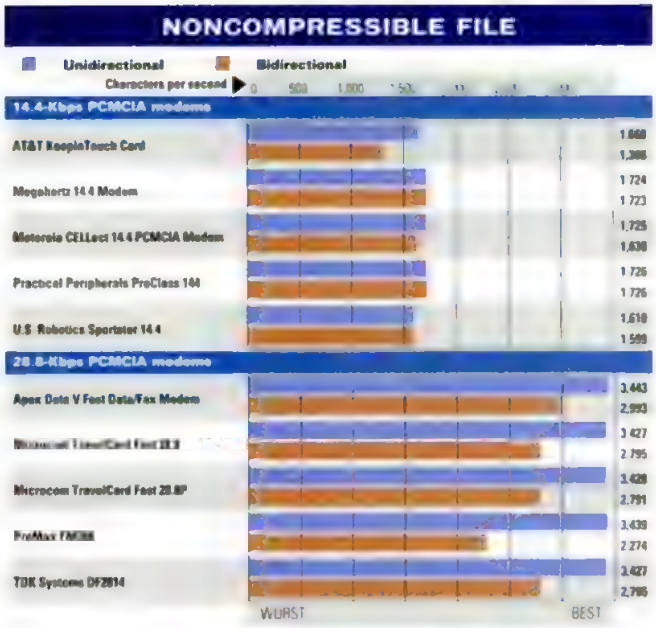
The **Telephone Network Simulation** test evaluates how a modem handles the line interface. We use one file type for this test: the moderately compressible text file. The TAS simulators are configured according to the EIA/TIA committee's PSTN profile defined in the TSB-38 standard. For this test we disable compression. The data is transferred unidirectionally, just once over most of the lines and several times over the most common lines. If a modem failed a transfer on a particular line, we attempted a second call. If the modem was unable to connect after two attempts, it scored 0 for that part of the test. The single score is arrived at by a series of calculations assessing throughput against EIA/TIA's survey of the existing telephone network.

Because this article is not intended as a full roundup, we do not include here all the details of our standard modem-testing methodology, even though these modems were tested against those methods. For more details, refer to the performance test section in "Hurry Up & Wait," September 13, 1994.

SLIGHTLY COMPRESSIBLE EXECUTABLE FILE

N/A—Not applicable. The product could not perform this test

NONCOMPRESSIBLE FILE

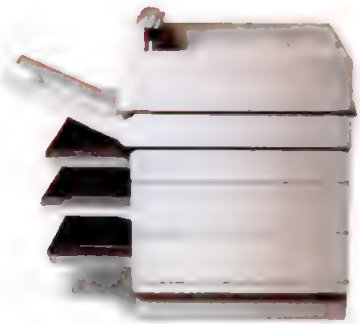


COMBINATION FILE

N/A—Not applicable. The product could not perform this test

TELEPHONE NETWORK SIMULATION

THE (*desktop laser printers that talk back to you*) COMPANY



Sorry, I'm all out of 11x1

I'm ready.

I'm not.

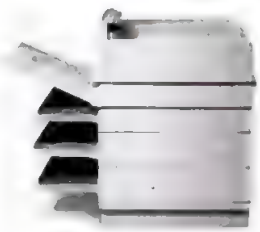
Hey, anybody got a job for me, I'm bored.

THE DOCUMENT COMPANY

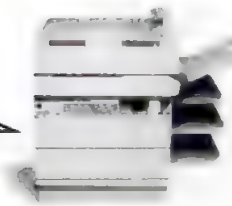
XEROX

Don't worry. Your job is next.

What resolution do you want to print at?



Your stuff's ready. Come get it.



My charge-back reports are ready, anytime.

Try the printer on 5, I hear he's full of it.

That's a lot of pages. The 4520 down the hall has the speed you need.

Network printers should do more than print pages. They should also make an imprint on the way you work with documents. That's why the Xerox 4500 series of desktop laser printers comes with Document Services for Printing. For instance, while you work at your PC, this intuitive software tells you which printer fits your job best, when a job is done, if paper is out, and a bunch of other stuff, all in real time. What's more, with 600 x 600 dpi resolution and our unique TrueRes smoothing, all the jagged edges and graphics of characters are eliminated. Result: You make better-looking documents easily and more productively. And with the Xerox Total Satisfaction Guarantee, you have backup that makes sure you stay productive for three full years. So why settle for printers you don't have to think about, when you can now get printers that think about you? Talk back to us, by calling 1-800-ASK-XEROX ext. 965.

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CIRCLE 942 ON READER SERVICE CARD

Reach for the Stars

By Frank J. Derfler, Jr.

Enough of these mundane LAN adapters and modems in the PCMCIA slot. Let's do something really cool with our computers—like navigation!

One of the most interesting devices made in the PCMCIA format is a receiver for the Global Positioning System (GPS) satellite grid. I recently tried out a Trimble (800-874-6253) Mobile GPS receiver ($795) with my Toshiba Satellite T1910CS when I went for a 4-day, 400-mile cruise across the Gulf of Mexico. With the PCMCIA GPS receiver in place, my Toshiba could tell me where I was at anytime; I needed only to glance at the screen.

Although Trimble's WinMobile software would have given me a nice display showing latitude, longitude, course, and speed, I went the next step and loaded the couple-hundred megabytes of Resolution Mapping Inc.'s (617-860-0430) Maptech Professional marine chart software ($1,290) into my PC.

Resolution Mapping's software contains high-quality digital images of standard nautical charts complete with depth readings and navigation markers. This software takes information from the GPS and shows you where you are, while also keeping track of your planned routes. You can also enter other data, such as fuel consumption information, into the program, and it will project whether you'll still be cruising at the end of the day—or whether you'll be merely floating.

Granted, my use of a PCMCIA GPS receiver was idyllic, but there are hundreds of more practical uses in the works. Many pen-based computing applications—from reading utility meters to issuing speeding tickets—can be enhanced with the exact position and time information delivered by GPS. Realtors and surveyors can use digital cameras and other devices to capture an image and then electronically annotate the location information. Truckers, hikers, and indeed all travelers can benefit from the combination of computer processing power, GPS time and place information, and the convenience of the PCMCIA compact design.

The PCMCIA GPS market has only two manufacturers, Trimble and Rockwell Telecommunications. But there are lots of integrators and resellers. In addition, Rockwell doesn't sell its products under its own name. You might buy a Rockwell GPS card from a company such as Road Scholar Software Inc. (800-426-7623), which markets highway navigation software. And Socket Communications Inc. (800-552-3300), a major PCMCIA company, will sell a value-added version of Trimble's mobile GPS cards.

PCMCIA GPS is simple to use. And it surely will inspire many interesting applications for hand-held and notebook PCs. Not a bad reach for this diminutive technology. □

Our tests were based on the assumption that these products will be used with notebook PCs in offices and hotel rooms equipped with analog phone jacks. For the sake of consistency and comparison, we also tested these modems' performance the same way we test the performance of desktop modems (although desktop use of PCMCIA modems is still rare).

COVERING THE NETWORK

Although performance is arguably secondary to convenience with PCMCIA modems, it certainly affects the size of those hotel telephone bills. Therefore, for many mobile laptop users, the single critical performance parameter is how well a modem works over the entire telephone network.

(This is particularly important because many major U.S. cities have not updated their telephone technology for some time. Many of the advances that make communications easier are being introduced first in the suburbs. For this we can thank the Public Service Commissions of the various states, whose capital spending rules allow telephone equipment to be upgraded only every so many years.)

On our whole-network model, the TDK DF2814, the Microcom TravelCard 28.8, and the Microcom TravelCard 28.8P modems performed virtually identically. This wasn't a surprise since they share the same data pump and telephone interface technology. These three modems also compared favorably with the Microcom DeskPorte FAST desktop modem, which performed only slightly better than its pint-sized siblings.

Whereas the TDK and both the Microcom modems maintained their top speed over about 55 percent of the network, the PreMax modem couldn't hold top speed over more than about 5 percent of the network. The PreMax modem, however, held its own as network conditions got progressively worse. The Apex V.Fast Data/Fax Modem was a comparatively poor performer, dropping to half-speed over 50 percent of the network model.

The differences in network coverage among the 14.4-Kbps modems were not significant. The AT&T KeepInTouch Card was the best at connecting over the entire model.

THE OLD DATA STREAM

Unidirectional throughput tests help to gauge basic file-transfer speeds. Among the 28.8-Kbps modems, only the PreMax FM288 did not keep up with the others. The U.S. Robotics Sportster 14.4 was slower than the other 14.4-Kbps products in most of the tests, but not by a significant margin.

Bidirectional transfer was a different story, with all of the modems showing considerable performance degradation. This wasn't surprising considering that the scaled-down size of these devices limits the amount of horsepower that can be crammed into a Type II case. That's no excuse, however, for the failure of the Apex Data, Megahertz, and PreMax

Technologies modems to pass data accurately in both directions.

CRUCIAL CONNECTORS

The compact, solid-state nature of PCMCIA devices means not only that they have fewer parts, but also that the parts are standardized, which makes replacements relatively painless. The ne plus ultra of handiness is attained when the special PCMCIA connector cable is one of the parts that can be eliminated. This is exactly what Megahertz has done.

The Megahertz modem's XJack (an RJ-11 connector housed in a spring-mounted frame built right into the Type II modem card) lets you use an ordinary phone cable with the modem. You're not going to lose the XJack (unless you lose your whole modem), and it is remarkably sturdy.

One drawback of the XJack is that if you try to use it in a two-slot system and the connector of the second card extends across the XJack's opening, you're out of luck. Another issue is that the telephone-connector pins are exposed in the XJack, thereby presenting a small but definite shock hazard that doesn't exist with any other design.

The other modems provide cables that connect the modem's internal telephone interface to a standard RJ-11 jack. Apex Data, Megahertz, PreMax, and TDK provide a coupler (RJ-11 jack to RJ-11 jack) that lets you unplug the line from your hotel telephone and connect the line to your modem.

Several other of the modem makers (AT&T Paradyne, Practical Peripherals, and U.S. Robotics) each use a proprietary cable. Damage it or lose it, and you're probably out of touch for a while. TDK and Motorola use a "standard" PCMCIA cable—which means you might be able to get a replacement cable quickly at a store where you are. In any case, a spare cable is a worthwhile investment for peace of mind.

DANGER—HIGH VOLTAGE!

Overseas versions of these modems, especially those intended for use in Europe, replace the cable with the dreaded *dongle*. A dongle consists of a short cable with a connector for the PCMCIA card at one end and a rather fat, square shell that contains a phone jack at the other. The dongle is essential in Europe because the high-voltage immunity requirements there are too high for a Type II PCMCIA card to handle on its own. Type III cards have enough clearance, as do 16-mm cards (which are unofficially known as "Type IV"), but few notebook PCs apart from Toshiba systems can handle these cards.

In addition, some hotel telephone systems are notoriously hazardous to modems. So-called "digital PBX" systems have so much voltage on their lines that the modem blows a fuse or fries a critical component (leaving you with a dead modem in a critical situation when you have urgent e-mail to send).

Although the manuals for many of these PCMCIA modems discuss the dangers of plugging into digital PBXs, only one of the modems we looked at for this article offers a tangible safety device. Megahertz provides protection through a power sensor built into the modem. If the power is too high to handle, the modem forces a disconnection and issues an error message.

The Megahertz modem's power-sensor feature, however, has a potentially annoying side effect: It can be triggered by many analog PBX systems. So trying to use the Megahertz modem in an office on an otherwise perfectly good telephone line can be a problem. There is, however, a fix. You need to insert DC resistance between the modem and the PBX. But such a fix is not yet commercially available, so you'll need to have one fashioned.

Such an adapter cable could be used with any modem, either PCMCIA or external, that's connected to a local PBX. But you couldn't use it with standard telephone lines because the resistance of the cable combined with the resistance of the telephone system might be too high for the modem to work properly. Frequent fliers would be well advised to include such a cable in their travel kits, along with other adapters.

Other modem makers have beefed up their modems to suffer the indignity of high-pressure electrons without incurring significant damage. While not as positive a safety measure as the Megahertz approach, this approach does offer the benefit of working with all analog telephone systems without difficulties.

▶ SUMMARY OF FEATURES

PCMCIA 14.4-Kbps Modems

Products listed in alphabetical order ■ = YES □ = NO	AT&T KeepinTouch Card	Megahertz 14.4Kbps PCMCIA Modem with XJack	Motorola CELLect 14.4 PCMCIA Modem	Practical Peripherals ProClass PCMCIA 144	U.S. Robotics Sportster 14.4 Data/Fax PCMCIA 2.1
List price	$349	$299	$329	$229	$259
Cable					
Connector type	Two-pin with RJ-11	N/A ❶	15-pin with RJ-11	15-pin with RJ-11	15-pin with two RJ-11s
Locking	■	N/A ❶	□	■	■
Polarized	N/A ❷	N/A ❶	■	■	■
Extra coupler	□	N/A ❶	■	□	□
Card and socket services	Enabler only	Award Software, Databook, Phoenix, SystemSoft	Enabler only	Enabler only	CardSoft, SystemSoft
Included fax software	QuickLink II FAX	FaxWorks Data 3.0	FaxTalk Plus	QuickLink II FAX, WinFax Lite 3.0	QuickLink II FAX
Cellular support	Optional	Optional	■	□	□
Security	□	■	□	□	□
Remote configuration	□	■	■	□	□
Caller ID support	□	□	□	□	□
Flash memory	□	■	■	■	□
Leased-line mode	□	■	□	■	□
Hayes AutoSync mode	■	■	□	■	□
Warranty	5 years	5 years	2 years	5 years	5 years

N/A ❶—Not applicable. The product does not have this feature

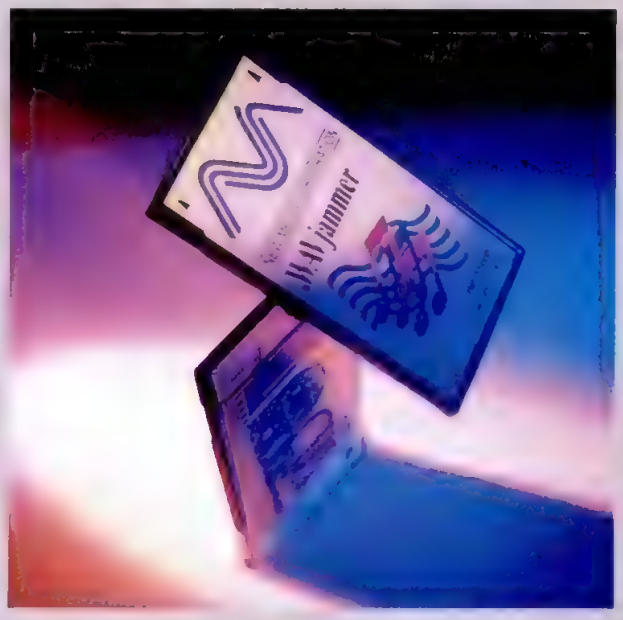
N/A ❷—Not applicable. A two-pin cable does not need to be polarized

At the PCMCIA Vanguard

By Stephen Satchell

Lots of different standard PC peripherals are squeezing their way into PCMCIA—or PC Card—format. But don't expect prices to shrink with them.

Even for an industry in which explosive growth is the rule, the actual meaning of "PCMCIA" became obsolete amazingly quickly. Its original intent was to define credit card–size memory cards. But memory has little to do with the newest of these cards. They now offer such capabilities as LAN access, hard disks, sound generation, and even video capture.



Moreover, because the PCMCIA slot that was designed for memory cards is really no more than a tiny ISA slot, and because the power-on and control procedures for the corresponding add-ons involve protocols rather than hardware configurations, any device that fits into a standard ISA slot will fit, sooner or later, into what is now called a PC Card slot.

The 16-mm slot, for example, is roomy enough to accommodate mechanical components. So if enough power is present at the connector, you can plug a 100MB hard disk into your notebook PC. In fact, PC Card hard disks are available in capacities ranging from 40MB to 170MB, at prices of about $295 to $649.

Although these prices are reminiscent of early hard disk prices, they probably won't drop the same way. The demanding nature of this lilliputian technology will keep prices a bit high, but should drop to around a dollar per megabyte.

If your notebook PC doesn't have the huge slots that the hard-disk cards require, you can buy a PCMCIA SCSI adapter to talk to an external hard disk. Companies who make these adapters include AST Research at $269 (800-876-4278), MagicRAM at $275 (800-272-6242), New Media Corp. at $359 (800-453-0550), and QLogic Corp. at $229.95 (800-867-7274).

In addition to hard disks, multimedia hardware will probably establish a beachhead in notebook PCs in about a tenth the time it took to become commonplace on desktop PCs. Typical of the coming products is the New Media .WAVjammer, a well-accessorized 16-bit CD-quality stereo sound card for portable systems.

This low-power-consumption card includes a stereo microphone and line inputs, a multiple ⅛-inch input, and three different outputs (microphone, headphone, and line). It lets you record and play back audio material at sampling rates (fidelity) ranging from 8 to 44.1 KHz. It also offers a 20-voice FM synthesis capability.

The .WAVjammer card includes the Microsoft Windows Sound System 2.0, which offers a voice-recognition capability called Voice Pilot that lets you give meaningful spoken instructions to your PC. Another company, Ositech (800-563-2386), offers an Ethernet adapter and stereo audio in one card.

If audio isn't enough, another class of PC Card products lets you capture motion video, screen stills, and live video overlays, and display the result on the LCD screen of a notebook or palmtop PC in 256 colors or 256 shades of gray. A typical video capture with the plug-and-play Focus PCMCIA Type II Live Video Capture Card from I/OMagic Corp. (714-727-7466) runs at 16 to 25 frames per second at a frame size of 160 by 120 pixels.

Different frame sizes and/or gray scale (rather than color) give you better performance—up to 30 frames per second. The maximum frame size is 320 by 240 pixels (which is one-half the size of a standard 640-by-480 screen). This is because the card has room for only so much video RAM. Fast, big, or cheap: pick two.

The I/OMagic Corp. card is compatible with Microsoft Video for Windows, and is bundled with Lenel MediaRecorder and Multimedia Works' software, which lets you work with graphics, animation, audio, and video. You can also play analog and digital multimedia. The capture of images from CD-ROM is supported by the software, rather than by the card.

The Focus card accepts input from camcorders, VCRs, videodisk, and NTSC- and PAL-compatible sources, and includes a video-connector module for that purpose.

It's good that internal hard disk capacities are up and prices are down, though, because video PC Card devices are hungry for room and RAM. Count on an initial investment of at least 8MB to 10MB of RAM and 25MB of disk space. You pay for that kind of miniaturization somewhere. □

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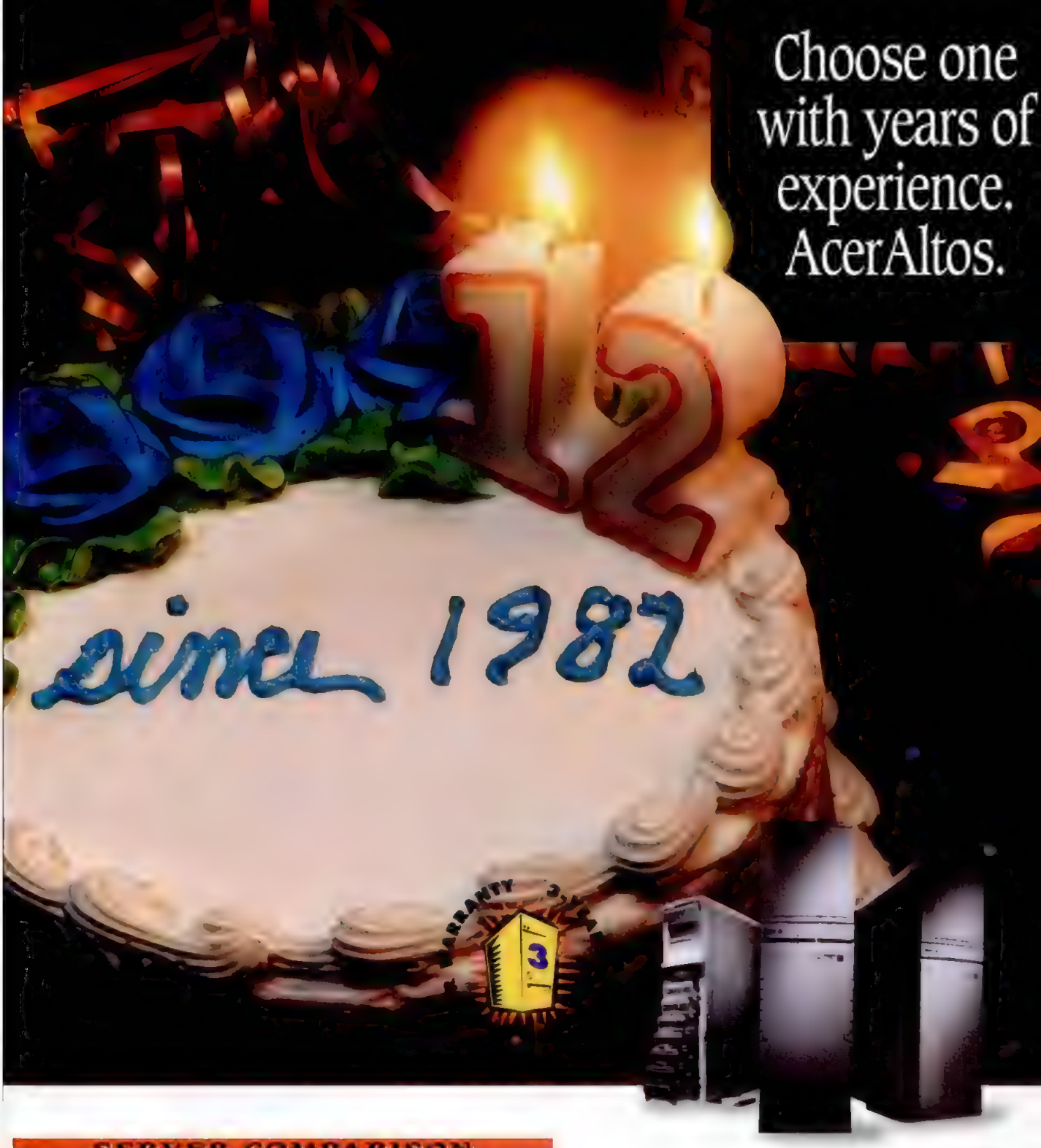

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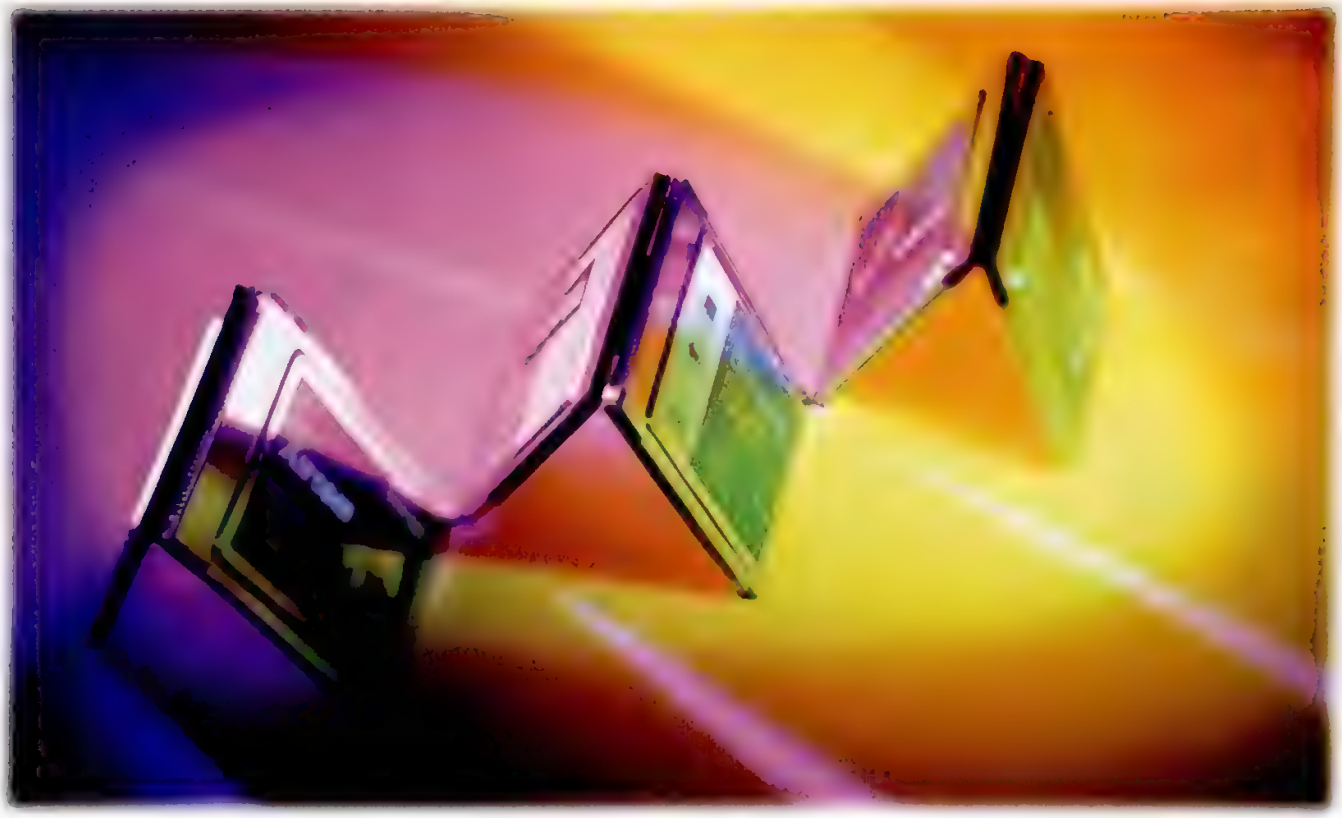


PCMCIA LAN ADAPTERS

MAKE YOUR NOTEBOOK A NETWORK NODE

By Stephen Satchell and H.B.J. Clifford

The power and storage capacity of a 1960s mainframe computer now fit in a briefcase—and cost less than the IBM PC AT you bought in 1984. Frequent travelers can choose to use their notebook PCs as their sole machines, thanks to notebook-size 170MB hard disks and PCMCIA LAN adapters. Farewell to anxiously downloading critical files from the desktop PC to a floppy disk or notebook PC as the clock ticks on toward take-off time.

This flexibility (and blunder-proofing) is made possible by the PCMCIA LAN adapter. Plug it into your notebook PC and watch the horizon of your "portable office" expand. When you're at your own desk, you can share data, access servers, archive critical documents, and back up a big hard disk.

As with modem cards, convenience is important when selecting PCMCIA LAN adapters. Performance is even more important, though, because your use of the network can affect others (for example, during massive relational database updates).

Time doesn't stop while you download information from a server, so the faster your LAN card does its job, the faster you are on your way. Finally, the adapter has to work with the NOS and also with your notebook's OS; configuring a LAN adapter for the first time can be a long and frustrating experience.

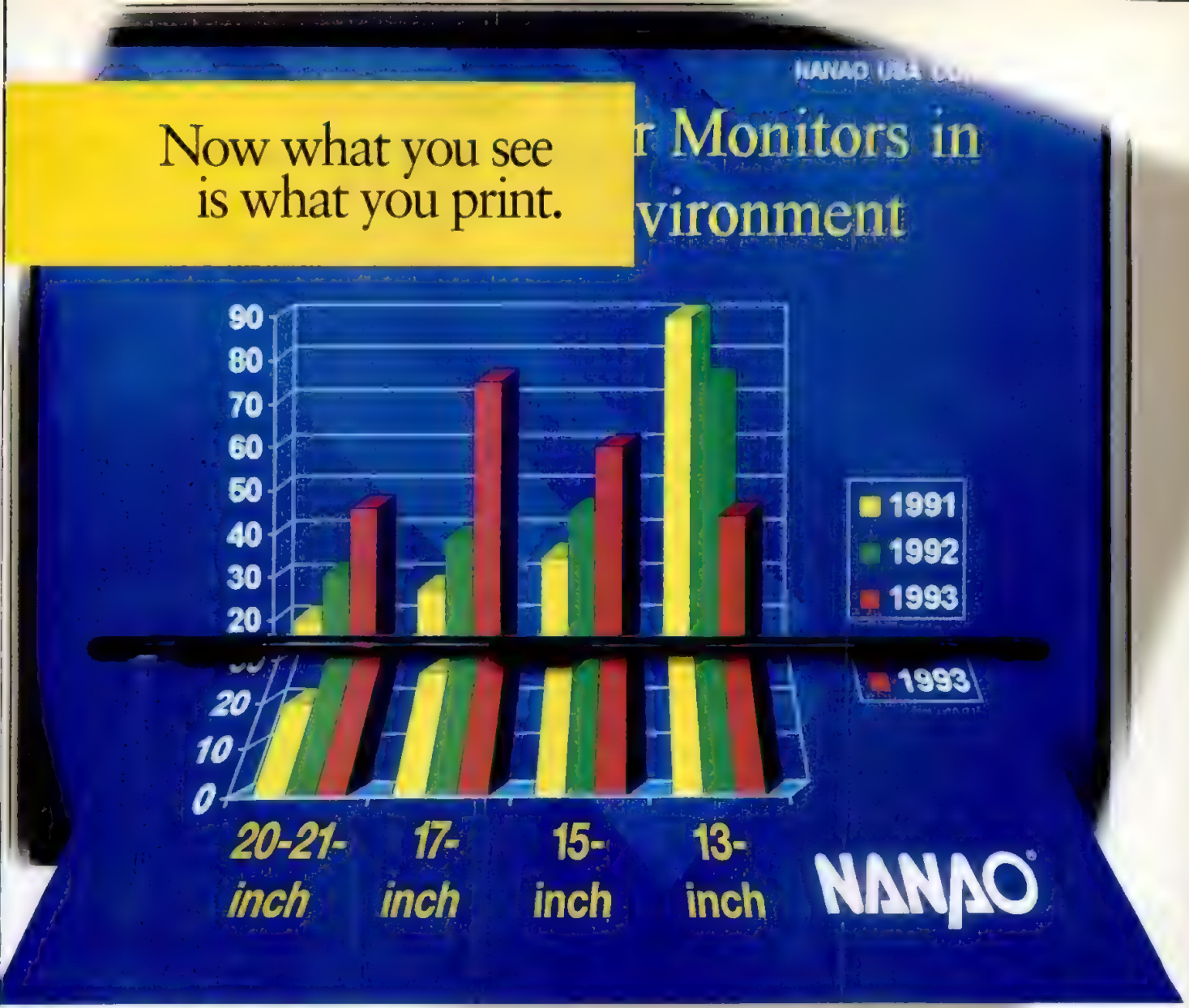
This snapshot of PCMCIA LAN adapters covers three Ethernet PCMCIA cards—the Xircom Performance Series CreditCard Ethernet Adapter IIps, the Megahertz PCMCIA Ethernet Adapter, and the 3Com EtherLink III—as well as the IBM 16/4 Token Ring Credit Card Adapter II. We also looked at two comnination cards: the Megahertz PCMCIA Ethernet Modem and Xircom's CreditCard Ethernet+Modem II.

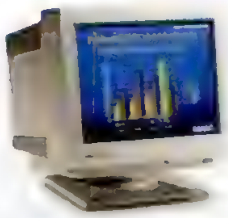
CABLES AND CONVENIENCE

All four of these cards are Type II, so they fit a wide variety of physical sockets. The Xircom and Megahertz network interface cards (NICs) use dongles with either RJ-45 jacks or BNC connectors. The 3Com Etherlink's 10BaseT connection uses a cable terminated in an RJ-45 plug or in a small box with a BNC connector. The IBM Token-Ring adapter provides both a cable to connect to unshielded twisted-pair cable and an adapter for shielded cable.

On all four, the end of either the cable or the dongle has a positive lock. The three Ethernet cards have finger releases. On the IBM adapter, there is an interest-

Now what you see is what you print.





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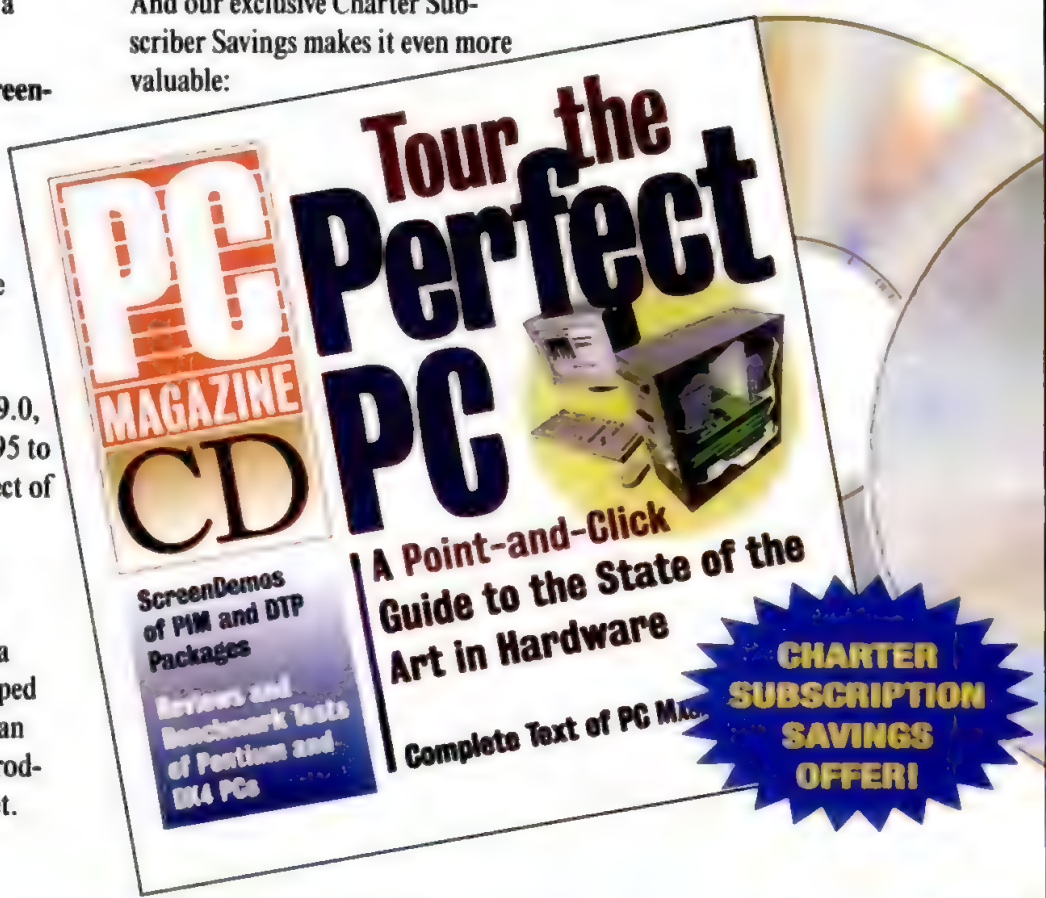

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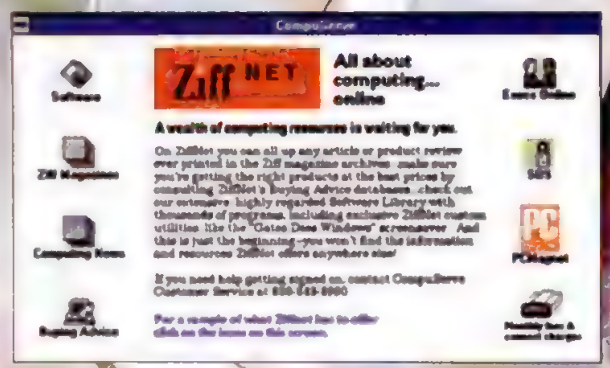

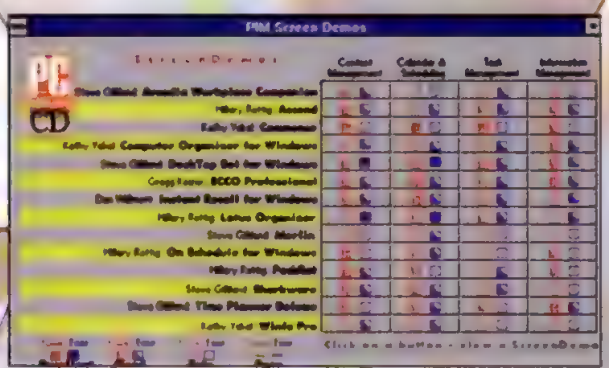

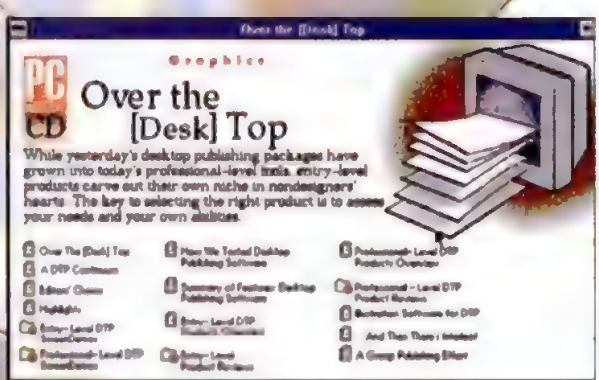

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Performance Tests: PCMCIA LAN Adapters

What the Numbers Mean

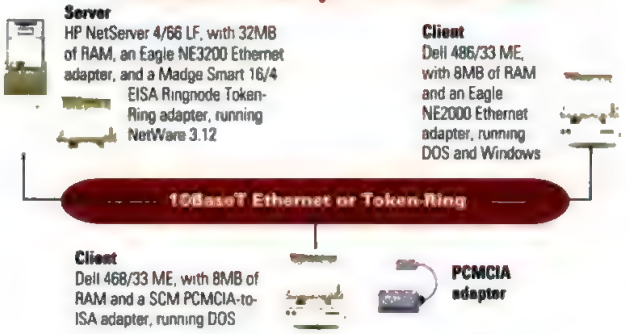
Just as when we last tested a full roundup of Ethernet and Token-Ring PCMCIA LAN adapters, our results for this sampling show virtually equal performance across the field.

When we last reviewed Ethernet and Token-Ring PCMCIA adapters ("Compact Connections," December 21, 1993), the performance numbers were nearly identical across the board. We found that products in this current mix of Ethernet and Token-Ring adapters also keep up with their ISA counterparts. All of the PCMCIA adapters in this roundup performed better than the slowest ISA adapters, but not as well as the best (according to results of ongoing ISA adapter tests at ZD Labs).

In our sampling, the Ethernet-only Xircom Performance Series CreditCard Ethernet Adapter IIps performed slightly better than the Xircom CreditCard Ethernet+Modem II and the Megahertz PCMCIA Ethernet Modem, each of which combines a modem and an Ethernet card. The extra overhead required for the combined functions may be the reason for the slower performance. The Ethernet-only Megahertz PCMCIA Ethernet Adapter, however, achieved nearly the same test results as the Megahertz combination product. We expected to see a slight performance enhancement, but we found that the Megahertz Ethernet-only adapter contains the same technology found in the company's combination Ethernet and modem product.

—Analysis written by Tim Crawford

PCMCIA Adapter Test-Bed



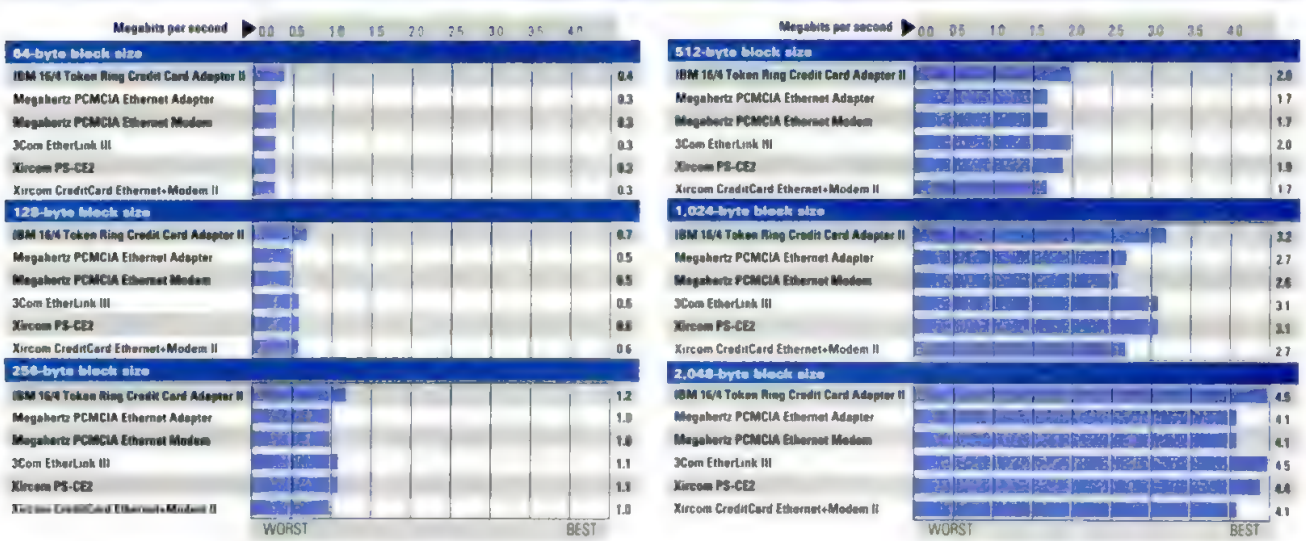
How We Tested

We used the **NIC Throughput** test from NetBench 3.0 to measure the throughput of the PCMCIA LAN adapters. The test evaluates the amount of data an adapter can transfer across the network in 1 second. A PC equipped with the adapter issues read requests to a file stored in a server's cache. We repeat the throughput test using 64-, 128-, 256-, 512-, 1,024-, and 2,048-byte block sizes to simulate what you might typically find over an Ethernet or Token-Ring network. We report results in megabits per second.

For our test-bed, we created a network that consisted of one NetBench client, one NetBench control workstation, and one file server. Our NetWare, Version 3.12, server was an HP NetServer 4/66 LF with a 486DX2/66 CPU and 32MB of RAM. For server network adapters, we used an Eagle Technology NE3200 in Ethernet testing and Madge Networks' Smart 16/4 EISA Ringnode in Token-Ring testing. On the client side, we tested the PCMCIA adapters' performance on a Dell 486/33 ME PC with 8MB of RAM and a SCM PCMCIA-to-ISA adapter.

Each PCMCIA card was inserted into the SCM PCMCIA-to-ISA adapter during the NIC Throughput test. The client system was configured with NetWare's VLM client drivers and DOS 6.2. No special optimizations were made for either the clients or the server.

NIC THROUGHPUT



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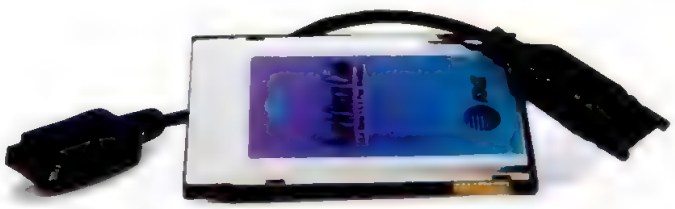

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ing sliding lock that lets you leave the connection unsecured.

The three Ethernet cards all have indicators that tell you when the 10BaseT connection has been properly made and when there's traffic on the network—important information if you're having problems. The 3Com and Xircom Ethernet products also include diagnostic software that lets you determine quickly whether a problem is in your laptop (and where) or further along in the network. The IBM Token-Ring also includes diagnostics.

To judge from the laptop compatibility documentation, these NICs are even more finicky than modem cards. 3Com even lists the few systems that are incompatible with its adapter and offers, on request, an update. The vendors do, however, mention enough compatible systems to minimize any fear that your notebook will be left out in the cold.

NOS compatibility can be a problem, particularly when you first set up a card to work with a particular network. Xircom's documentation is the model for describing how to configure the adapter. The manual includes instructions for the majority of NOSs, and the Xircom NIC package also includes software for DOS, Windows, Windows NT, and OS/2. The other three cards aren't nearly so comprehensive. (NetWare users need not worry.) If possible, make sure that all your sites are using the same NOS.

SPEED: PROPORTIONAL TO PACKET SIZE

If you're using your notebook PC as your primary system, speed is a major consideration, especially for access to your LAN. Using NetBench, we compared the performance of all four cards against the performance of standard ISA network interface controllers.

Make your notebook your sole PC—PCMCIA LAN adapters perform similarly to desktop adapters.

The PCMCIA cards performed about the same as desktop adapters. The difference is more evident with smaller packets, such as the ones used in transaction-based systems. Remote storage uses larger packets, so the performance differential here is less noticeable.

We verified 3Com's claim of being faster than other PCMCIA Ethernet adapters, although for larger packets the speed difference was too small to matter.

TWO IN ONE: NO SYNERGY

We also took a quick look at combination cards from Megahertz and Xircom that contain both a modem and an Ethernet adapter. These products let you access a LAN locally at LAN speeds, and can also function as modems when you're on the road. The performance of the Ethernet portion of the combination card, although slower than their single-function brandmates, would be acceptable for most apps.□

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First Looks

▶ LOTUS NOTES WORKFLOW SOFTWARE

Closing the Workflow Gap

Weaving documents through the corporate bureaucracy may be too much, even for Lotus Notes, unless of course you have one of these four workflow add-ons.

By Tony Pompili

Corporate workflow and Lotus Notes. They seem joined at the hip these days. Workflow software enables groups to move and manage information among themselves. Notes, a workgroup package with workflow capabilities, is slowly infiltrating companies on a department-by-department and organization-wide basis. But no sooner do network managers buy into Notes than they start bumping their heads on the Notes' workflow ceiling.

So we tested four products—Action Technologies' ActionWorkflow System, WorkFlow's FlowMaker, Version 1.1, Application Partners' WIT The API Library, Version 3.0, and Reach Software Corp.'s WorkMAN for Lotus Notes, Version 1.01—that let you bridge the Notes workflow gap. Standalone versions of two of these products—ActionWorkflow System and WorkMAN—were reviewed in our past workflow story ("Go with the Flow," June 14, 1994). We categorize those standalone versions like the products reviewed here as low-end workflow solutions that add sequential routing, conditional branching, parallel routing, or all three to basic e-mail. FlowMaker and WIT are Notes-only products; FlowMaker lets developers simplify workflow organization and planning, while WIT adds workflow commands to Notes.

In general these products let you use Notes to create predictable processes such as requisition-approval systems. Users familiar with Notes will find the packages simple to use. Developers will be happy, since they will still gain the

Leave a *brief* message at the tone, page NE25

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Total Control's scalable architecture and open design guards against obsolescence and protects your investment. The chassis is built to accommodate new technologies as they become available; the modular design and available TDM and packet bus bandwidth provide for future expansion.

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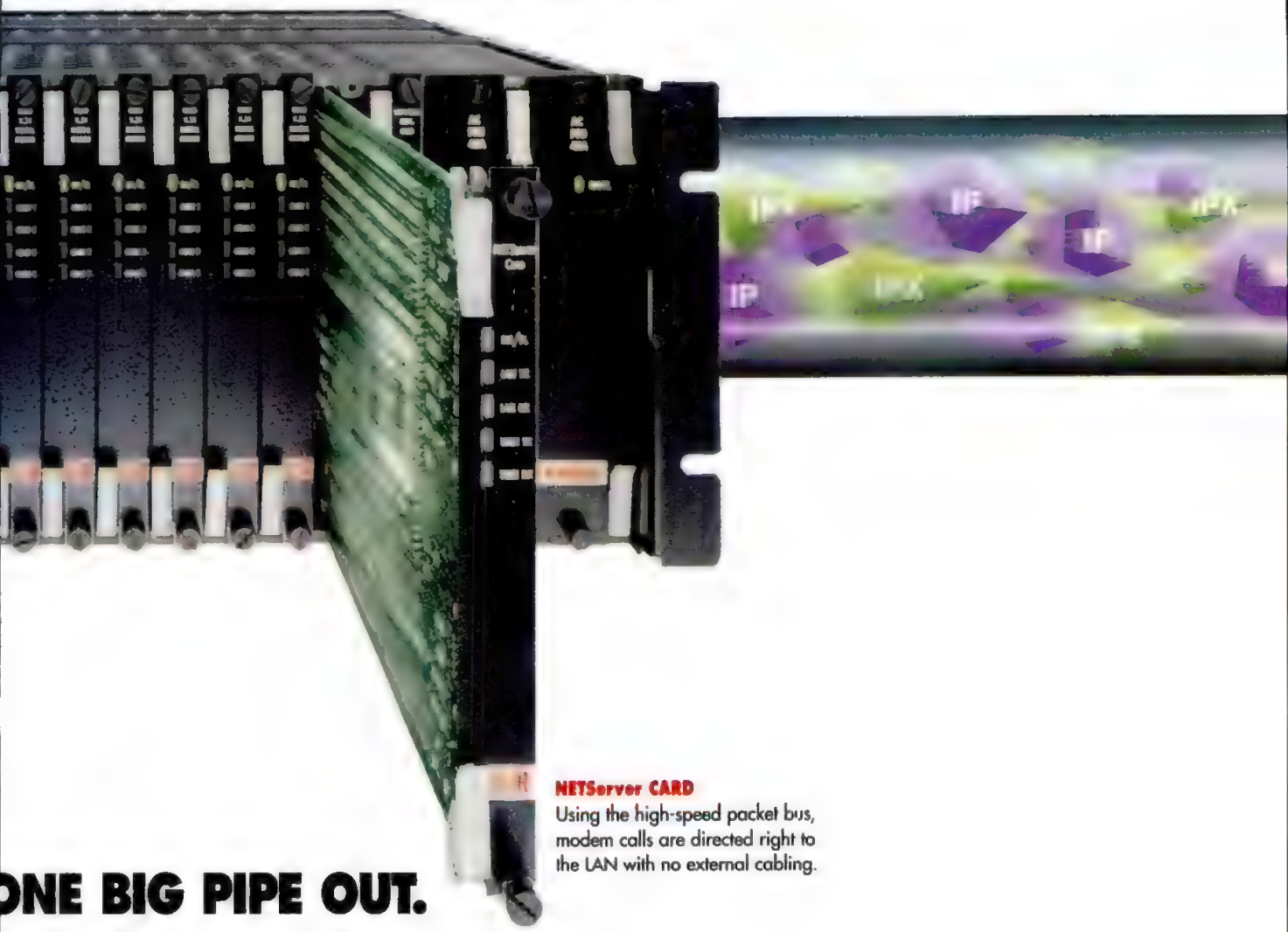

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functionality they need to build even the most complex workflows.

We found that ActionWorkflow handled our Notes workflow needs best. It has unparalleled development capabilities and a great server-based architecture. WorkMAN was a close second, offering the best graphical development interface through its WorkMAP tool and a reasonable price, but it places a hefty toll on the user's PC.

• ActionWorkflow System

ActionWorkflow Builder and ActionWorkflow Manager for Lotus Notes 1.5 (the two parts of the ActionWorkflow System we tested) integrate powerful development features into existing Notes environments and offer a graphical interface, Builder, to visualize the workflow. And as native Notes databases, ActionWorkflow applications need no additional workstation software. Though they are a little pricey, the ActionWorkflow packages nonetheless go a long way toward filling in many of Notes workflow gaps.

For those with more limited budgets, Reach Software Corp.'s WorkMAN for Lotus Notes, Version 1.01, offers an even more intuitive design program with WorkMAP, its visual tool component, at half of ActionWorkflow's price. But WorkMAN's engine needs to run on every workstation, making it more difficult to deploy and more hostile to the user's desktop.

NOTES: THE SOLUTION WITH PROBLEMS

Notes, in itself, is an impressive workflow application. It offers features attractive to organizations attempting to bring together ranks of users to solve business-workflow problems. Notes' decentralized structure gives companies a delivery system to extend workflow paths across servers connected by WANs, leased lines, and remote clients.

Nonprogrammers find that creating Notes applications, especially workflow applications, is a relatively simple task. Notes forms, with their programmable fields, give developers a powerful set of tools for creating input and information-delivery screens.

But all is not perfect. The programming capabilities of Notes macros are pathetic. The macro structure is restrictive, with its primitive subroutine capabilities. Background macros run hourly at best and can act only upon a single database, which makes multidatabase document processing difficult.

As for application development and planning tools, don't try and find anything under the Design menu. Lotus's oversights have spurned a small group of well-known, and unknown, companies, to fill in Notes' gaps with a group of Notes workflow application-enabling tools.

WHAT FILLS YOUR GAP?

The initial problem for the Notes workflow developer is design. How does the workflow look? Notes offers no workflow-design tools, a gap filled by products such as ActionWorkflow and WorkMAN.

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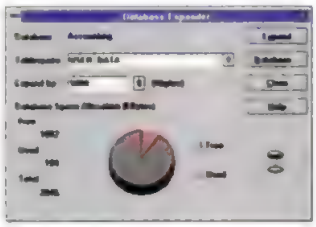

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They both include powerful front-end graphical development environments, which you can use to map out the workflows visually, complete with the workflow participants (called roles), assign tasks, and create links and rules to see what the workflow looks like. FlowMaker's text-based outline leaves much to the imagination, but it's still better than native Notes.

Notes application development involves building what appears to be a disparate set of formulas, fields, forms, and databases to create workflow. ActionWorkflow, FlowMaker, and WorkMAN all take a top-down approach to development, designing the Notes databases based on the workflow design rather than creating separate, interrelated forms, macros, and other database elements to produce a workflow. After completing a graphical workflow design, ActionWorkflow and WorkMAN generate the workflow code, greatly reducing the development time. FlowMaker requires a fair amount of manual intervention to convert its workflow into a working Notes application but again it's better than nothing.

A much-touted feature of Notes is its security, or access control, a decentralized process within a Notes application; the ability to set access rights is scattered throughout the application. In a workflow application access rights are constantly changing. At one point in the process, an end user should be able to enter a request. At the next stage, the service manager should be able to respond to the request but not modify the end user's entry. ActionWorkflow is good at integrating centralized access control as part of its development and server process. While FlowMaker and WorkMAN insert group and individual names into their workflow designs, there's still a fair amount of work in the Notes address book actually to implement the access controls.

Finally, macro capabilities for doing batch updates and document processing, which are limited in Notes, are handled far more elegantly by ActionWorkflow, WIT, and WorkMAN. WIT, with its collection of powerful API calls, can move and update documents and document elements among any server-based databases with a few commands.

ARCHITECTURES ON ARCHITECTURES

With these solutions come new architectures that may add new complexities to your existing Notes environment. FlowMaker is the cleanest solution, affecting Notes servers and user workstations the least. It requires no workstation modifications or additions to the Notes server. At the next level is WIT, a polling application, which is fairly small—about 160K. It runs on the server and can be set to poll frequently or infrequently depending on the application's needs and server load.

ActionWorkflow adds a more complex server task called the Manager and a handful of ActionWorkflow systems databases to your Notes servers.

Finally, WorkMAN gets intertwined on each users' workstation. Each individual workstation needs to be upgraded with WorkMAN software and the software, a workflow engine, runs concurrently with Notes, at times slowing down performance in order to run server tasks.

IN FOR A PENNY . . .

If you've been involved at all with rolling out Notes in your company, by now you're immune to sticker shock. Notes is a product that often has six-figure startup costs. Those Notes sites that begin with a lower price tag often grow overnight.

We therefore asked the vendors to price a 25-user, 3-server Notes development system with one developer package. WorkMAN came in lowest at $5,185. The remaining packages were a bit pricier. An ActionWorkflow System setup would cost $10,995, and WIT is priced at $11,995. FlowMaker is particularly expensive. The $9,995 price seems comparable, but this buys you a development system that can be accessed from one PC only .

Clearly, then, if you only want workflow, there are more economical choices than Notes. But if you have Notes, and you want a workflow package, take a look at these products. One of them should help fill your Notes workflow gap.

Suitability to Task: Lotus Notes Workflow Software

A Lotus Notes–based workflow package must address the needs of both the developer and the Notes administrator. Appropriately, then, we paid careful attention to issues that affect both groups, focusing on installation, workflow creation, tracking and reporting, systems management, and application support.

Installation Here we look for packages that install easily into existing Notes servers and (when necessary) clients. We expect server components to be able to find the Notes API and other programs and databases with a minimum amount of difficulty. With Notes probably preinstalled on most clients, we didn't expect to have to install

Workflow creation Here we look for tools that enhance the design, development, and implementation of Notes workflow applications. Graphical design interfaces are an advantage, since workflow is often described in flowchart-like formats. Also, we look for tight integration with Notes databases, Notes forms and fields, and the Notes development environment

Tracking and reporting Here we look for tools for monitoring and tracking workflow processes, preferably as Notes databases. Automatic notification of delays and other problems (such as users of tasks that are stalled in the pipeline) is important. Databases that audit the process to help developers pinpoint bottlenecks or system problems are also important

Systems management Since Notes is notorious for its octopus-like server-and-application management, we look for tools that centralize systems management as much as possible. These include tools that enable the management of roles, databases, forms, and other workflow-related elements.

Applications support Notes and workflow applications are intrinsically complex. We look at how well product vendors understand the Notes environment and how effectively they provide support for all aspects of the products - from installation to design troubleshooting to Notes-server management

SUITABILITY TO TASK

Product Name	
Installation	EXCELLENT
Workflow creation	GOOD
Tracking and reporting	FAIR
Systems management	POOR
Applications support	EXCELLENT

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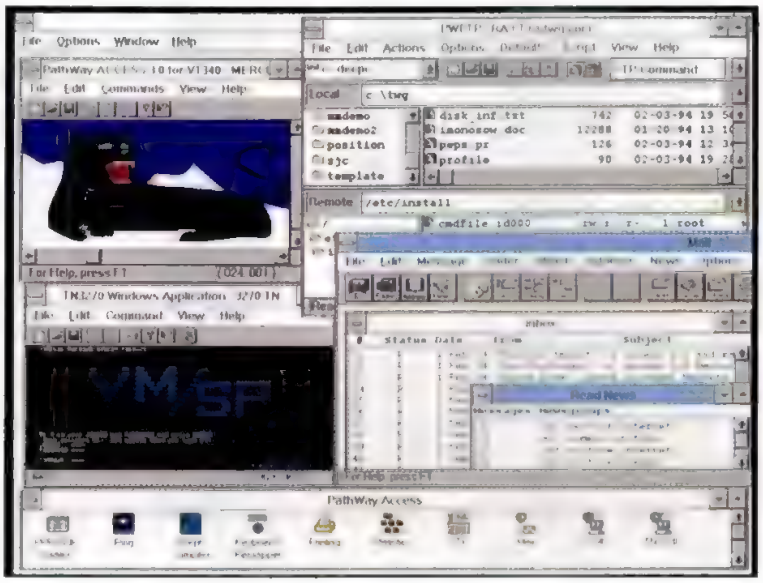

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CIRCLE 864 ON READER SERVICE CARD

NETWORK EDITION

EDITORS' CHOICE

Action Technologies Inc.

• ActionWorkflow System

Action Technologies, a longtime player in the workflow market, has created the most comprehensive Notes workflow-development product reviewed here. ActionWorkflow Builder and ActionWorkflow Manager for Lotus Notes, Version 1.5—components in the ActionWorkflow System—are the only products we looked at that create workflows from forms to formulas without requiring users to touch the Notes Design menu. We reviewed Builder for developing applications and Manager for running those applications. We did not review the third product in the ActionWorkflow System, ActionWorkflow Analyst.

Builder provides a powerful graphical development environment. Although its design interface is not as intuitive as WorkMAN's, Builder gives you many of the same abilities to set up tasks and users and then link them together, creating a graphical representation of a workflow. Manager is an OS/2 Notes server task that processes most of the ActionWorkflow documents. Builder and Manager combined complement Notes' basic workflow features while remaining fairly transparent to users.

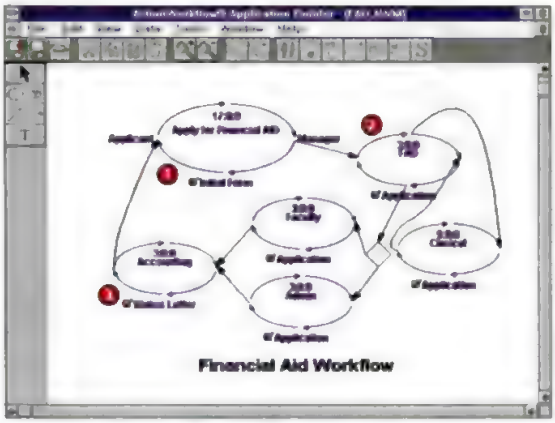
The ActionWorkflow paradigm takes a little getting used to at first. Its workflow process, called the Business Process, presumes that all workflow applications consist of a client and a performer. Other subprocesses connect from cell to cell at specified points. The combined organism is the workflow.

SUITABILITY TO TASK	ActionWorkflow System
Installation	EXCELLENT
Workflow creation	EXCELLENT
Tracking and reporting	GOOD
Systems management	EXCELLENT
Applications support	GOOD

The paradigm can take a while to master, and it's a bit tricky understanding how these processes work and where links to the other subprocesses can occur. You are helped somewhat by the included (and updated) version of Workbox, which illustrates many basic workflow tasks, such as creating to-do lists and scheduling meetings. Still, we found the paradigm quite difficult to use.

Processes show up as circles with series of arrows on the Builder interface. As with WorkMAN, you can use basic drawing tools to link processes together. The end process looks much more like the flow with WorkMAN than with the ActionWorkflow products, however.

And like WorkMAN, the ActionWorkflow products are intimately connected to Notes and Notes databases via the Notes API. People or role assignments can be added to the workflow process by simply selecting them from pick lists. Builder goes one step further than WorkMAN in creating the actual forms with fields and formulas defined in the Builder process. Besides Notes databases, Builder can also create workflow applications that can be run from SQL databases. The interface is identical to WorkMAN's, with some minor dialog box and setup differences.



Financial Aid Workflow

1. The applicant (the client) initiates the main process, Apply for Financial Aid, by filling out the indicated Notes form. The maximum duration for this process is 17 days.
2. The manager (the performer) sends the form to the first subprocess, the financial aid department (FAD).
3. The application continues through the workflow being modified by various departments—FAD, clerical, and faculty—until accounting sends a letter to the applicant.

The applications found in Builder and Manager create more complex interrelationship structures of Notes databases than the apps found in the other products reviewed here. Builder-generated applications create forms in a central ActionWorkflow Transaction Notes database. The workflow definitions—the rules that govern the workflow—are placed in another Notes database. These system databases, as well as a few other databases, form the combined ActionWorkflow application. Users need be concerned only with the Transaction Notes database, which is where all new forms for workflow applications are—by default—placed.

Users launch workflow processes by composing Notes forms from the Transaction Notes database as they would in any Notes application. Since the Transaction Notes database contains forms from other ActionWorkflow applications, however, the Notes Compose menu list can start getting a bit crowded. Luckily, you can make the process easier to use by storing ActionWorkflow applications in up to six database files.

When you set up Manager, you create the ActionWorkflow system database. Both are easy to get up and running thanks to a well-designed OS/2 Presentation Manager application.

One of the first tasks when installing the Notes Manager is to add licensed ActionWorkflow users via an administrator task called Authenticate. With Authenticate, you can assign role rights to administrators, designers, and other users, enabling them to modify ActionWorkflow applications.

Manager's regular task is to modify or move documents based on the workflow definitions created in Builder. You choose how often Manager processes workflow requests, a feature really appreciated by Notes administrators of busy servers.

Notes forms created by Builder are generated from a standard ActionWorkflow Notes template (.NTF) file. As Notes forms, they can be edited using the Notes Form Design tools, which is good in case you still need to make some small changes.

A downside to the ActionWorkflow architecture is that it requires users to work from databases on the server running Manager. This makes it difficult for users in decentralized, dial-up, or remotely linked sites to share the same workflow. You can, however, run discrete applications on multiple ActionWorkflow servers.

These ActionWorkflow products greatly simplify the planning, design, and

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implementation of Notes workflow applications. They are simple to deploy, and with a separate package—ActionWorkflow Analyst—developers and system analysts can be walked through the process of developing workflow applications. Though their server components add little to server overhead, they do limit access to common workflows by dial-up and decentralized Notes users.

▶ **ActionWorkflow Builder; ActionWorkflow Manager for Lotus Notes, Version 1.5.** List price: *For 10 users, $2,000; developer pack, $4,995 (for three-developer license).* Action Technologies Inc., *1301 Marina Village Pkwy., Alameda, CA 94501; 800-967-5356, 510-521-6190; fax 510-769-0596.*

Circle 952 on reader service card

WorkFlow Inc.

•FlowMaker

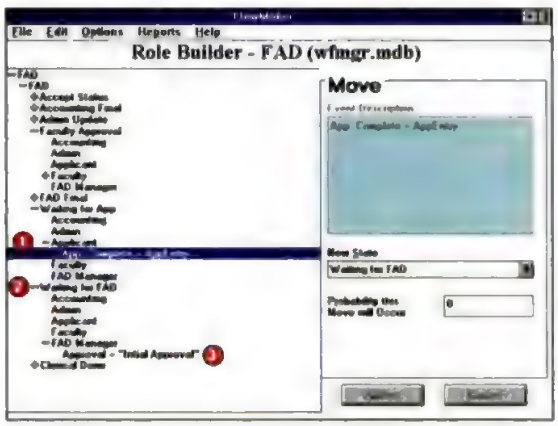
WorkFlow's FlowMaker, Version 1.1, offers useful tools for developing Lotus Notes workflow applications without the need for server or client add-on products.

FlowMaker is really a workflow design adviser: It focuses on defining the basic workflow and produces a standard Notes application built with typical Notes field formulas. There is no server agent as ActionWorkflow and WIT The API Library have. There are no workstation add-ons as used by WorkMAN for Lotus Notes. You just have good old Notes, giving FlowMaker the most unobtrusive installation of any product reviewed.

While invisible to the user, FlowMaker will certainly raise an eyebrow or two with the business manager. It costs $9,995 per developer, far more than the other products here. There are, however, no user or server license fees. FlowMaker is a developer's tool that runs only on a single database developer's workstation. Workflow protects its license with a dongle connected to that PC's parallel port. WorkFlow stores the workflow definitions and description in a Microsoft Access database. So you can view and generate reports with Access or compatible programs.

Step-by-step, FlowMaker's development environment takes you through the process of defining the workflow, creating formulas, and then transferring those formulas into preexisting forms. It cannot create the actual Notes database forms or perform any of the steps that actually set up the Notes database.

FlowMaker workflow definitions are organized in textual outlines as simple lists, while the ActionWorkflow products display workflows as graphical circles linked by arrow lines. You design FlowMaker workflows around the state or status of a workflow. For example, in our test application a state was a college administrator rating a financial-aid applicant. Based on the rating, FlowMaker uses move events to change the value of a field or fields to move the document through the workflow.



1. An outline divides the workflow into states, roles (the participating people), moves, and move events. In order for the state, Waiting for the Application, to be completed, the role (the applicant) must submit a Notes form.
2. The system then goes to the next state—Waiting for Approval from the Financial Aid Department (FAD)—where the FAD manager approves the form (3).

FlowMaker's outline text model is helpful in organizing actions around these states. The workflow looks like a program, letting you see workflow-definition parameters in a small space. But we prefer a GUI for visualizing a workflow.

Based on what states and moves you create in the outline, FlowMaker creates actual field formulas that are used within the Notes forms. You type in many of the formula's elements yourself. FlowMaker parses the formula for accuracy, in a way similar to the Notes formula-parsing process. You can then create the formula and insert it directly into the form field. This process is a little cumbersome and prone to human error, since it involves little more than cutting and pasting the formula from FlowMaker directly into the Notes form. This illustrates one of the shortcomings of FlowMaker: It uses a parallel rather than an integrated development system. Unlike WorkMAN or the ActionFlow System, FlowMaker does not use the Notes API to create dynamic links with the actual Notes database. For example, to define lists of workflow users, or roles, in FlowMaker, we manually typed in the role name; with ActionWorkflow we selected user names from a pick list gleaned from the address book. Field names also had to be entered manually to be accessible to formulas within FlowMaker. This slows down the development process and introduces inevitable transcription errors caused by users reentering field names.

FlowMaker has two outlines referred to as Builders. The Roles Builder shows the workflow by roles, assigning rights to access the workflow documents in certain states of the workflow. The Section Builder outline breaks the workflow process into workflow states.

Unfortunately, documentation is nonexistent. There isn't even a demonstration application to help you learn the ropes. You'll need to use the on-line help and tutorial.

SUITABILITY TO TASK

FlowMaker

Installation	EXCELLENT
Workflow creation	FAIR
Tracking and reporting	GOOD
Systems management	FAIR
Applications support	FAIR

FlowMaker's concise outline format and unobtrusive installation are both attractive. But its parallel development process is tedious, and its price tag is high. If you can't touch your Notes infrastructure, consider FlowMaker. But if you want to make an application entirely in one environment consider ActionWorkflow.

▶ **FlowMaker, Version 1.1.** List price: *$9,995 per developer.* Workflow Inc., *135 Commns Ct., Chadds Ford, PA 19317; 610-459-9487; fax, 610-459-7895.*

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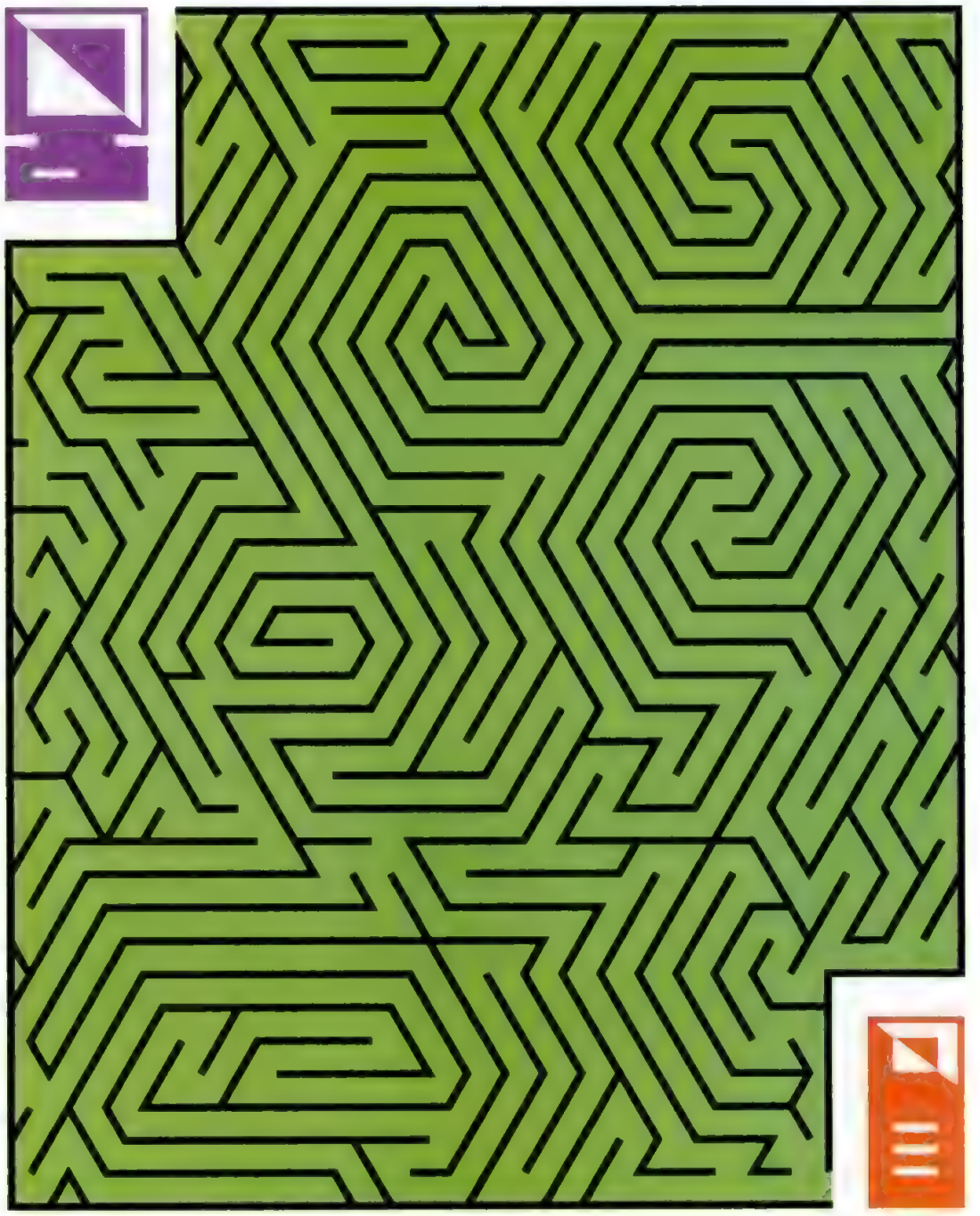

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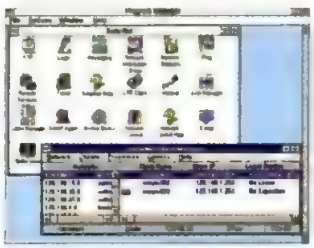

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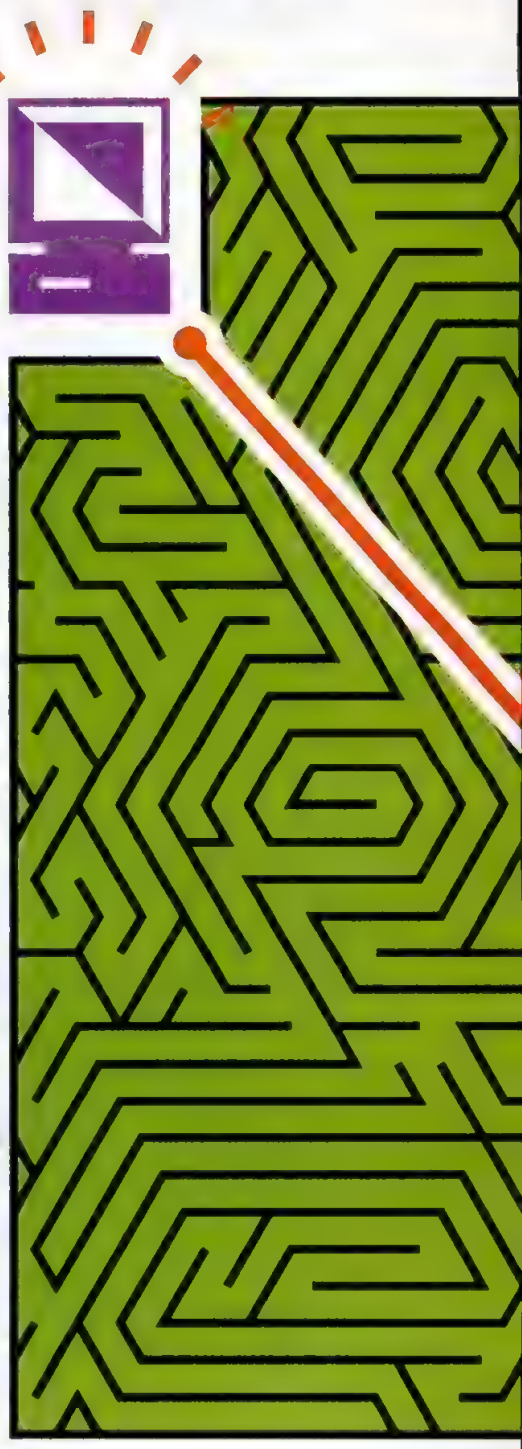

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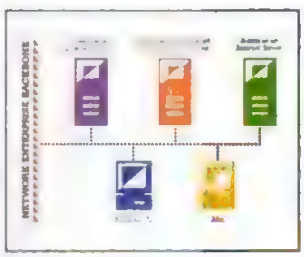

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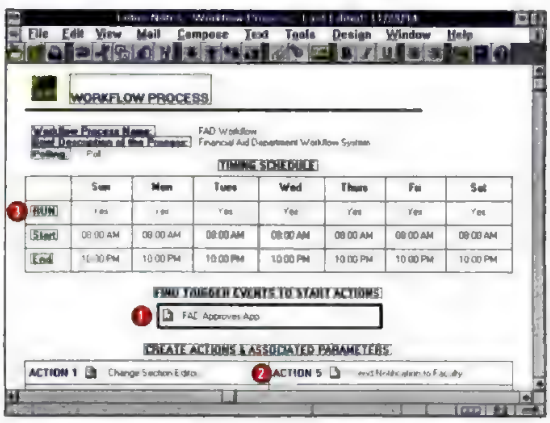
Application Partners Inc.

• WIT The API Library

Applications Partners' WIT The API Library, Version 3.0, is a back-scratcher application meant to get at those hard-to-reach problems in your workflow. Though it offers no database planning or design features, WIT is a collection of API calls that can be used to provide certain automation capabilities not currently available directly with native Notes.

WIT includes 49 specific actions; it can move a document from one database to another or modify fields in specified documents. Version 3.0 brings 19 new calls to the library, such as the ability to launch other server applications like a backup program. It can also mail-enable any call, making it possible to notify users or groups whenever an action occurred. Unlike Notes macros, these calls can span multiple databases rather than acting on just one database. Since the WIT environment is less workflow-specific than ActionWorkflow, WorkMAN, or FlowMaker, the WIT environment is also less useful for developing entire Notes workflow applications. Still, WIT does work with any Notes database and is incredibly flexible, once you get your arms around it.

WIT is an OS/2 Notes server-based product. Similar to ActionWorkflow Manager, it runs against server API. WIT works under OS/2 1.3 or later and Notes server software 3.0 or later. Application Partners recently released WIT for Notes NT.



1. WIT's Control document defines the needed actions.
2. The actions are carried out when conditions in selected documents change.
3. Those actions can be triggered at any time during the week.

A server application, WIT must be running on the same server as the databases it is to process. Dial-in users with local copies of databases must replicate with a WIT server to insure that their local databases are current.

WIT APIs are initiated in the WIT Control database, a standard Notes database located on the server. For each set of processes, you create a WIT Control document in a standard Notes database. The document contains, among other things, a trigger definition. The trigger is a set of criteria that will launch the WIT process. For example, the trigger could be a Notes document that was created but not acted upon for five days. WIT would be triggered by the inactivity and would mail a message to the person expected to act on the document, attaching a Notes hypertext-like DocLink to the message.

The server program scans databases and documents specified in the Control documents until conditions are met. If it finds a document to act on, it then initiates the API to accomplish the action.

You will need to pore over the WIT reference manual to understand the Control document; only limited on-line help is available. There's also an out-of-the-box application that lets you move specific documents among databases. It's a start, but a more practical workflow application would certainly be more helpful. To its credit, Application Partners includes on-site training for new customers with the package.

As with ActionWorkflow, you can specify how often WIT should scan databases. Although you can associate only one Control database with the engine, by assigning every process in that Control database to the same polling cycle, you can create multiple Control databases and run multiple engines on the same server. And since you pay per server, not per engine, the price remains the same.

You can further refine polling times in the control document for each group of actions, setting the times of day that the processes should run on a daily basis.

SUITABILITY TO TASK

WIT The API Library

Installation	EXCELLENT
Workflow creation	N/A
Tracking and reporting	N/A
Systems management	N/A
Applications support	GOOD

N/A - Not applicable. The product does not have this feature

WIT falls short in delivering many of the database design features found in other products. But its ability to perform specific workflow automation tasks on almost any Notes-server-based database with not much strain on your existing Notes-server makes it a powerful tool.

▶ **WIT The API Library, Version 3.0.** List price: *$3,995 (per server).* Application Partners Inc., *120 Wood Ave. S., 4th floor, Iselin, NJ 08830; 908-603-7742; fax, 908-603-7743.*

Circle 955 on reader service card

Reach Software Corp.

• WorkMAN for Lotus Notes

Reach Software Corp.'s WorkMAN for Lotus Notes, Version 1.01, gives developers a strong graphical workflow design and tight integration to the Notes workflow environment. But WorkMAN also puts much of the processing onto the network clients, which won't sit well with the user.

WorkMAN for Lotus Notes is the Notes version of Reach's proprietary Windows product WorkMAN. A program running on each WorkMAN user's PC, called the WorkMAN engine, runs in conjunction with Notes and processes workflow requests made by WorkMAN Notes applications. While the WorkMAN engine puts a great amount of the workflow control in the users' hands and enables powerful applications, WorkMAN also dumps the processing on the users at times delaying other Notes tasks.

WorkMAN uses no server code as the ActionWorkflow applications and WIT The API Library do. Developers create WorkMAN applications with Reach's WorkMAP visual tool component. WorkMAP features the richest graphical workflow-mapping system of all the products

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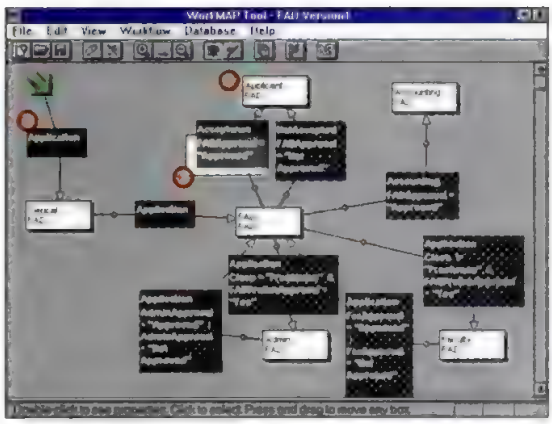
tested. Its intuitive interface combines the workflow-planning and application-development process into a few steps.

WorkMAN uses a role-based workflow paradigm. In testing, we first mapped out the people involved in the process by drawing role boxes on the screen and then linked those roles to the tasks and processes we wanted done. To plan the test workflow we simply created the roles, drew arrows to other roles with links and then defined these links to say what should happen between the two roles.

Double-clicking on a role or link brought up dialog boxes for defining specific actions such as changing values of fields or selecting new forms. Like the ActionWorkflow applications, WorkMAN works directly with the Notes application and Notes databases using the Notes API. This simplifies the development process. Using the Notes API, field names are gleaned directly from existing Notes databases. WorkMAN does not create forms but, like FlowMaker, uses preexisting forms and databases.



1. The workflow begins at the arrow where an application (a Notes form) is submitted to a role (the clerical department) and then sent to the financial aid department (FAD).
2. The criteria are checked.
3. If the criteria are met, the form (acceptance) is sent to the specific role, in this case the applicant.

WorkMAN stores its workflow definitions within the Notes database as an attachment. Unlike FlowMaker, WorkMAN does not create Notes field formulas that run as regular Notes applications. Instead, the workstation WorkMAN engine reads the WorkMAN attachment when a document is created and then acts accordingly, avoiding altogether the issue of creating field or macro formulas.

A user initiates WorkMAN by pushing a typical Notes button within a form. The button triggers a DDE call to the WorkMAN engine. With this architecture you need WorkMAP to edit or modify the workflow. The other tested products can tweak the application directly from within Notes.

The WorkMAN engine reads the workflow and determines what to do with the documents. If the Notes document is dealt with by another user, the engine sends a Notes mail message to the next role, or person. The engine on the receiving PC scans the user's mail file for WorkMAN documents. Once the mail

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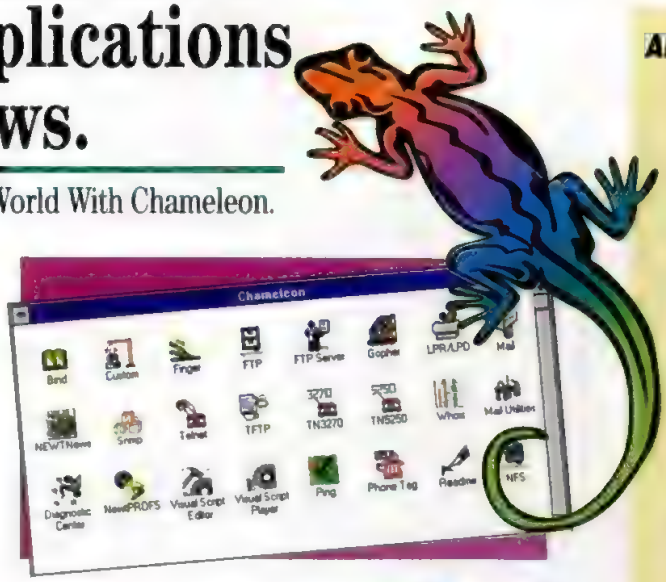

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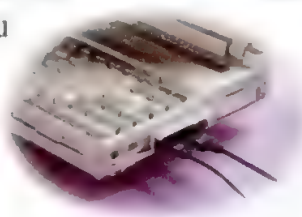

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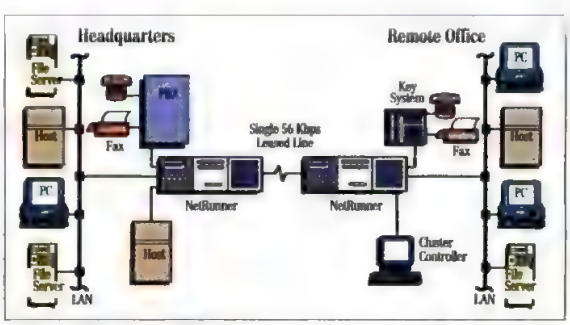

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CIRCLE 938 ON READER SERVICE CARD

file is found, the engine reads the WorkMAN definition and puts documents to be dealt with into a single database called Workflow Tasklist. Like ActionWorkflow, WorkMAN assumes that a user wants to deal with all workflow documents—regardless of the creating application—from a single database. While this saves users from checking multiple databases for work that needs attention, the Tasklist can become quite cluttered with files. What's more, this adds overhead to the individual clients, something that ActionWorkflow and WIT offload to the server.

WorkMAN's installation is also the most complicated of the products here, especially at the end user's workstation. You must first configure WorkMAN to run from the network or client for each user and then run a setup program on the client of any WorkMAN user.

SUITABILITY TO TASK WorkMAN for Lotus Notes	
Installation	GOOD
Workflow creation	EXCELLENT
Tracking and reporting	GOOD
Systems management	GOOD
Applications support	EXCELLENT

With this dependence on the end-user client architecture, WorkMAN fits cleanly into the Notes remote-user strategy. Since workflow is primarily mail-based, once it is configured by the network manager WorkMAN uses standard notes replication. While much of this is possible because users can also define roles at their clients, this setup can also override the roles and workflow structure, potentially disrupting the workflow.

Developing with WorkMAN is easier, but more intrusive, than developing with the other tested products. Still, you may want to reap its benefits, but plan to justify those installation pains.

▶ **WorkMAN for Lotus Notes, Version 1.01.** List price: *Runtime Base Pack for 10 users, $1,295; Developer Starter Kit for 2 users, $1,995.* Reach Software Corp., *872 Hermosa Dr., Sunnyvale, CA 94086; 800-624-5356; 408-733-8685; fax, 408-733-9265.*

Circle 954 on reader service card

TONY POMPILI is a Lotus Notes consultant and a frequent contibutor to *PC Magazine.*

▶ PCI QUAD ETHERNET ADAPTERS

PCI Gets a Jump

BY PADRAIC BOYLE

When your server's performance goes south, your only option may be to add a server adapter—if you have enough cash and expansion slots. But with only a few PCI slots available, there's a good chance you'll find yourself out of luck.

That is, unless you consider two new PCI Quad Ethernet adapters—Cogent Data Technologies' EM964 PCI Quartet TP (twisted pair) and Znyx Corp.'s EtherArray ZX314. Each is an individual network adapter that connects your server to four independent Ethernet segments. And each is much cheaper than the alternative—four EISA network adapters. Four one-port Eagle NE3200 adapters can cost approximately $2,000—a far cry from the $649 or $549 you'll spend for the PCI Quartet or the EtherArray, respectively.

These cards are so similar that you probably wouldn't go wrong with either one. We did prefer the slightly more expensive PCI Quartet, because it scored lower on our CPU Utilization test when it was used with Cogent client cards.

LOTS OF SIMILARITIES

The two cards have much in common—from their choice of chips to their LAN options. Both use Digital Equipment Corp.'s PCI-to-PCI bridge chip to connect the card to the PCI bus (see the diagram "How Quad Ethernet Works"). And you can use full-duplex Ethernet on each card to send and receive data at the same time on two different channels. As a result, you'll get aggregate throughput of 20 megabits per second between the server and a switch, over a single Ethernet link.

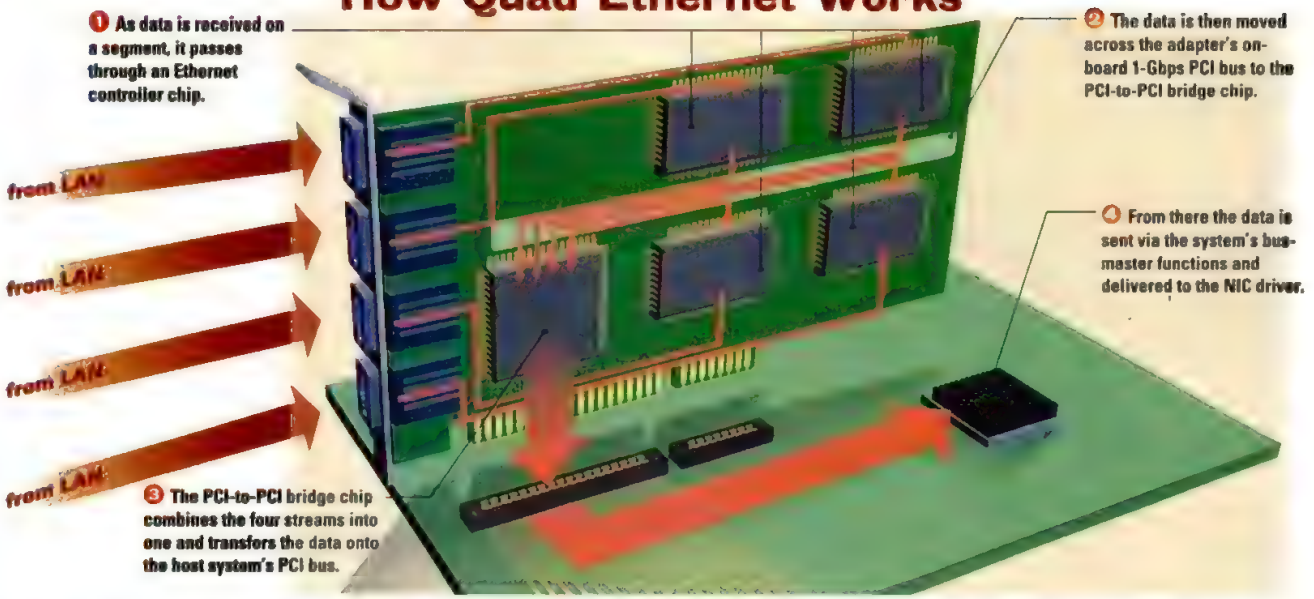
Both companies also simplify installation with specialized software. Because many BIOS manufacturers have never dealt with PCI-to-PCI bridge chips, adapters don't easily recognize them. Cogent's diagnostic program detects if the PCI's BIOS chip recognizes the board. It also adds the board to the system's EISA configuration, avoiding conflicts in interrupt assignments. Znyx's diagnostic tool programs the BIOS with the needed configuration information to get your adapter up and running. Znyx also provides an application for viewing the configuration of your system's PCI bus that shows what is housed in each slot and the interrupts that have been assigned.

KEY DIFFERENCES

The key differences between the cards are in their driver support, efficiency, and connection options. Both cards offer Open Data-link Interface (ODI) drivers for NetWare 3.*x* and 4.*x* servers and Microsoft Windows NT 3.1. The PCI Quartet, however, doesn't support the Network Driver Interface Specification (NDIS) used in many environments, most significantly Microsoft LAN Manager, Microsoft Windows for Workgroups, Microsoft Windows NT, OS/2 LAN Server, and Pathworks. The EtherArray offers drivers for all of these environments, as well as for Artisoft's LANtastic, and for Unix TCP/IP for SCO, Univel, and SunSoft applications. Cogent's card only supports NetWare and Windows NT.

Both cards performed well on our tests, however. For the smaller block sizes, they both utilized more CPU power than our EISA-adapter reference setup (four NE3200s). For larger block sizes, the PCI Quartet was far more efficient in its CPU utilization than the EtherArray or our four EISA adapters. The key here was Cogent's Predictive Pipelining technology. Predictive Pipelining is Cogent's proprietary technology that reduces the load on the CPU and increases through-

How Quad Ethernet Works



put by handling the data message-by-message rather than packet-by-packet. It allows the PCI Quartet to stream data faster and more efficiently across the LAN to clients that are equipped with Cogent eMaster+ adapters. In terms of speed, both adapters outperformed the reference EISA adapters. In addition to the EM964 PCI Quartet TP, Cogent offers a BNC version of the adapter. The EM964 PCI Quartet BNC ($698), however, doesn't support full-duplex mode. Znyx does not offer a BNC version of the EtherArray.

Each PCI Quad Ethernet adapter provides a solution for network administrators who have limited server slots available. And each adapter provides excellent speed. The decision may come down to the Znyx card's competitive price and impressive list of drivers or the Cogent card's low CPU usage.

▶ **EM964 PCI Quartet TP.** List price: *$649.* Cogent Data Technologies Inc., *175 West St., P.O. Box 926, Friday Harbor, WA 98250; 206-378-2929; fax, 206-378-2882.*

Circle 968 on reader service card

▶ **EtherArray ZX314.** List price: *$549.* Znyx Corp., *48501 Warm Springs Blvd., #107, Fremont, CA 94539; 510-249-0800; fax, 510-656-2460.*

Circle 969 on reader service card

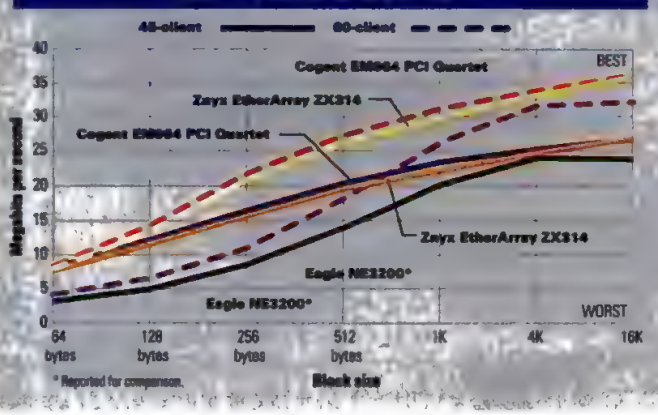
Benchmark Tests: PCI Quad Ethernet Adapters

PC MAGAZINE LABS

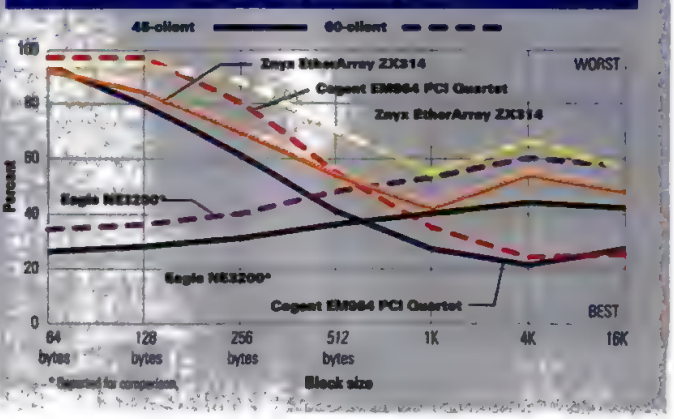
In terms of throughput, both the Cogent EM964 PCI Quartet and the Znyx EtherArray ZX314 outperformed our baseline unit, the Eagle NE3200. This was especially noticeable when the products were handling smaller block sizes. The Cogent was more efficient than the Znyx in terms of CPU utilization because of its Predictive Pipelining technology, which reduces CPU overhead and increases throughput. Predictive Pipelining establishes transparent connections between the client adapters and the server adapter. Larger amounts of information can be handled because data is sent in its entirety rather than in packets.

Our test-bed consisted of four 15-node networks, for a total of 60 clients (an even mix of 386 and 486 PCs), an HP NetServer LF 5/90 server running NetWare 3.12, and four Eagle NE3200s. We measured aggregate throughput using the **NIC Throughput** test from NetBench 3.0 and monitored **CPU Utilization** using Novell's STAT.NLM.

NIC THROUGHPUT



CPU UTILIZATION



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High Speed Finally Hits Home

Can the information superhighway coexist with HBO and MTV?

By Gary Gunnerson

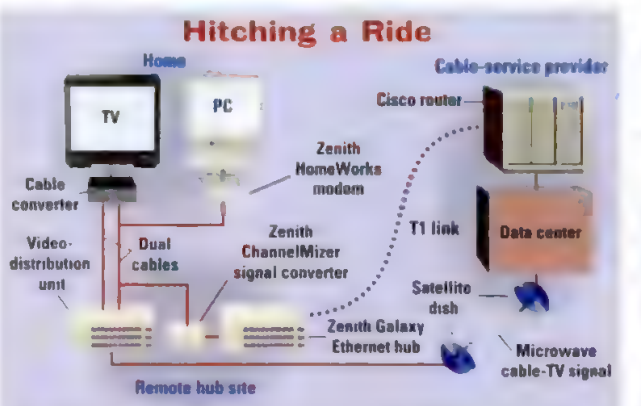
You wait patiently for the information superhighway to reach your door, but high-speed data access always seems to be restricted to the office. Your cable company wants to change that.

In fact, several cable television companies across the country are experimenting with different methods to provide data access over cable infrastructures. Of all of these companies, Media General Cable, of Fairfax County, Virginia, may be furthest along: It plans to roll out two-way, TCP/IP-based network service to its 200,000-plus subscribers early in 1995.

Why is this cable company so far ahead of the pack? One of the reasons is that Media General's infrastructure was designed to support two-way communications, mandatory for data access, from the time it was first installed in 1983. As it is, Media General's infrastructure can accommodate 120 TV stations in addition to several channels dedicated solely to data access. In a LAN environment, this would be like installing Category 5 cabling ten years ago. Most other cable companies do not have this advantage and will have to upgrade their networks to handle two-way cable traffic.

Another reason is that Media General's plans are remarkably similar to an Ethernet network running TCP/IP. The center of the network is a fully redundant data center (with backups and hot standby equipment for every major component). The data center transmits dual cable signals—one for TV, one for data—to ten remote hub sites, placed strategically around Fairfax County and covering an area of nearly 4,000 miles. Each of these sites, in turn, relays the signals to subscribers' homes, just as a workgroup hub relays information from a server to a client PC.

So what happens to the signals when they get to the subscriber's home? Media General's standard installation already places two primary cable drops in each home. Both cables connect to the TV, but one will now branch off to your PC as well. Although Media General hasn't finalized its system, initial plans call for the use of Zenith Electronic's $495 HomeWorks radio frequency (RF) modem at the PC. This device will support a maximum data rate of 500 kilobits per second. According to Media General, beta tests indicate that the modem can sustain more than 100 Kbps on a busy network. That's more than ten times the speed of a 9,600-bit-per-second modem and faster than a 64-Kbps ISDN Basic Rate Interface (BRI) circuit.



Media General's data service will piggyback TCP/IP transmissions over one of two cables to each subscriber's home.

Although the modem connects to your PC like any other peripheral, what happens behind the scenes is a bit more complicated. First, the signals from the modem travel over the cable to one of the remote hub sites, where the signal is converted to Ethernet by a Zenith ChannelMizer and passed to a Zenith Galaxy Ethernet Hub. The Galaxy Hubs are all connected to the data center via T1 lines and an array of Cisco routers (a 7000 and several 4000s and 2500s).

The question remains: What will you be able to do once this service is installed? At the outset, Media General subscribers will only be able to access the resources that the company makes available to them. The good news is that the Prodigy on-line service will be the first service offered over the Media General system. Subscribers will also be able to play network games or possibly even set up peer-to-peer networks with friends and neighbors.

Further plans by Media General include linking up with the Global School House, a project funded in part by the National Science Foundation that allows people across the country to participate in multimedia classes broadcast over the network. Unfortunately, there are not yet any immediate plans to provide complete Internet service to the home, although Media General claims to be working toward this goal.

For Fairfax County residents, the information superhighway is nearly complete. Residents of other regions may have to wait a bit longer for the local on-ramp to be built, but that wait is sure to be brief. □

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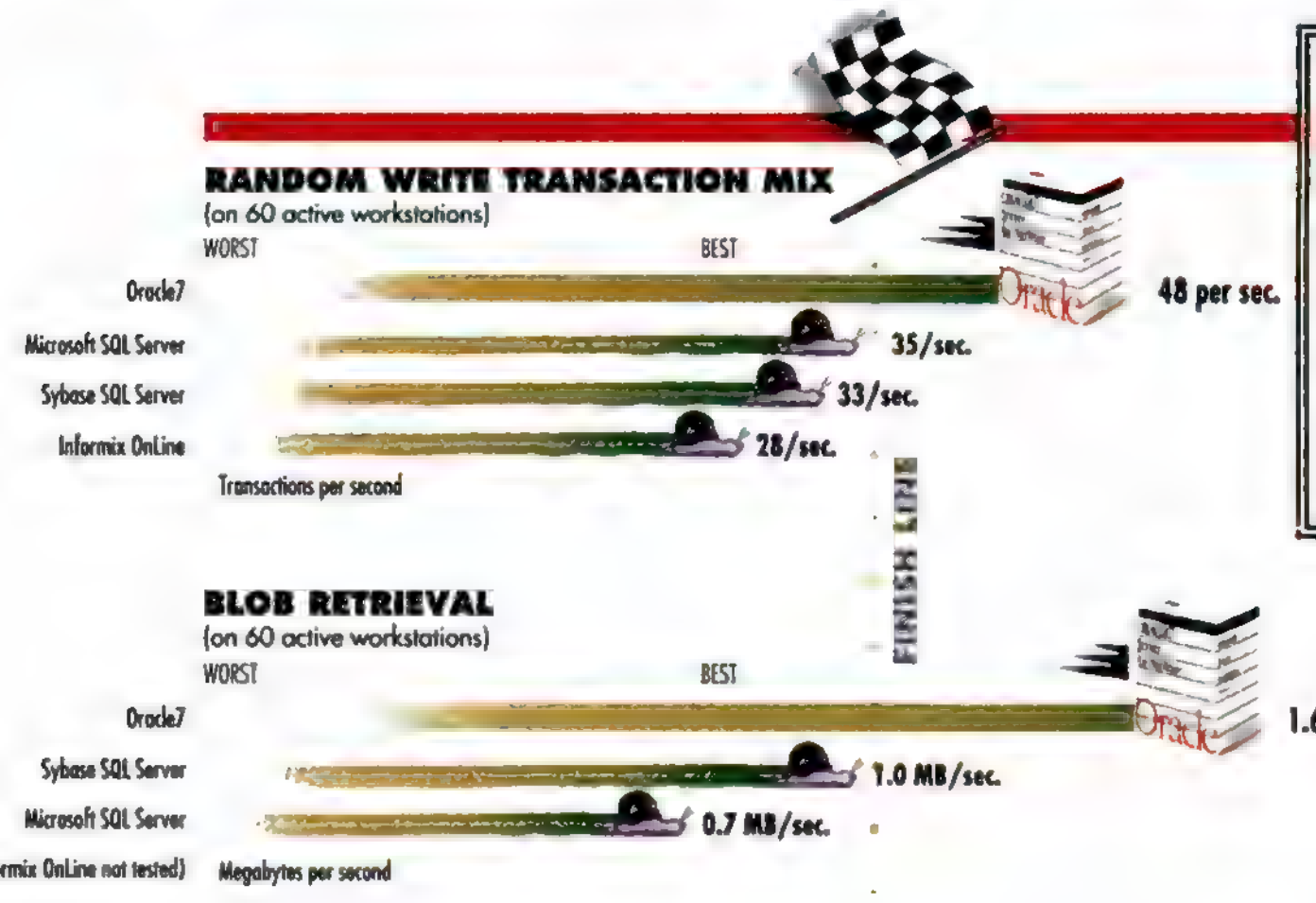

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Telephone Tyranny

By Diane Danielle

To Cold Callers Everywhere:

As you no doubt have noticed, you are leaving your message with an answering system, not a human being. It has a limited capacity for storing messages. I would therefore appreciate your stating your business succinctly. I am certain you have led an interesting life and have a world of information to pass on to me, but this is not the appropriate forum for such an extended discussion.

This answering system cannot ask you to repeat your name and phone number, so please give your number slowly or repeat it. And if you have an unusual last name, please spell it. I use a PIM (personal information manager) to log phone calls, and computer programs are finicky when it comes to keys such as last names and company names. If I don't get it right, I may never again find your message.

This answering system can replay your message, but the process is not easy and is fraught with risk: If I press the wrong button, I will erase the message. In addition, since it forces me to replay the entire message, if you have left a long one with your phone number at the end, I might not wait for it.

I will do my very best to respond to your call in a timely fashion, but it is not always possible to do so. I get, on the average, 50 phone calls a day. When I return from a 2-hour meeting, I may have 15 or 20 messages waiting that I must first log and then return.

Answering phone calls, however, is not my business. I am a network manager. I evaluate and install software and hardware, plan and monitor the installation of new networks, and respond to user requests for assistance. This is, indeed, why you are calling me.

Remember that I am a busy person. Also, I have not memorized every area code in the country. I may, therefore, return your call after your business day has ended. If you do not have an answering system of some kind, I will probably not try again. If your answering system requires me to know your phone extension or how to spell your last name and you have failed to leave the former or given me the spelling for the latter (assume I will need the spelling for any name more difficult than Jones or Smith), I may be similarly disinclined to try again.

Are you a reporter who needs a response by a specific time, or a vendor inviting me to some kind of seminar? If I do not return your call, that's because either I have received it after your deadline or I know that I will be unable to attend your shindig. I realize this practice would not pass Miss Manners's test of courtesy, but when you get as many phone calls as I get, some form of triage is essential.

My rules for returning calls are simple. First I answer those that come from the people who pay my salary: my managers and my users. Then I return calls from employees in other parts of the company who work with me on a regular basis or who need my assistance on some particular matter. Next come the calls from the vendors with which I have working relationships. Only when I have responded to all of those calls, in addition to doing my job, do I start returning cold calls.

Often you ask me if you can come to my office to discuss your services in detail. When I was a fledgling network manager I always said yes. I no longer always say yes. Such meetings inevitably last half an hour or more—perhaps due to my lack of a forceful enough character—and while 1 hour a week may not be unreasonable, several hours a week with people offering services I don't need is.

I don't have the time to teach you how to sell into my very, very decentralized company. Because most of my colleagues here get just as many phone calls as I do, many have asked that I not give their names and phone numbers to cold callers.

I am loyal to vendors that provide good service and will not drop them just because your company has a bigger name or can offer me a price that is 1 percent less than my preferred supplier's price. So although part of my job does involve the periodic evaluation and selection of vendors, please do not be offended if I turn down a request for a face-to-face meeting. I am merely trying to save both of us from wasting time.

Send me your literature; I'll call you when and if I become interested. Don't try to get around me by going to my boss. My boss will back me up, and you will have lost even the remotest possibility of ever doing business with me or any of my friends in this business.

Speak slowly and clearly. State your business briefly when you hear the beep. □

You are leaving your message on an answering system. State your business succinctly and hang up.

DIANE DANIELLE is an independent networking consultant in Berkeley, California. She can be reached on CompuServe at 70020,645 or MCI Mail at 383-1159.

Illustration by David Bamundo

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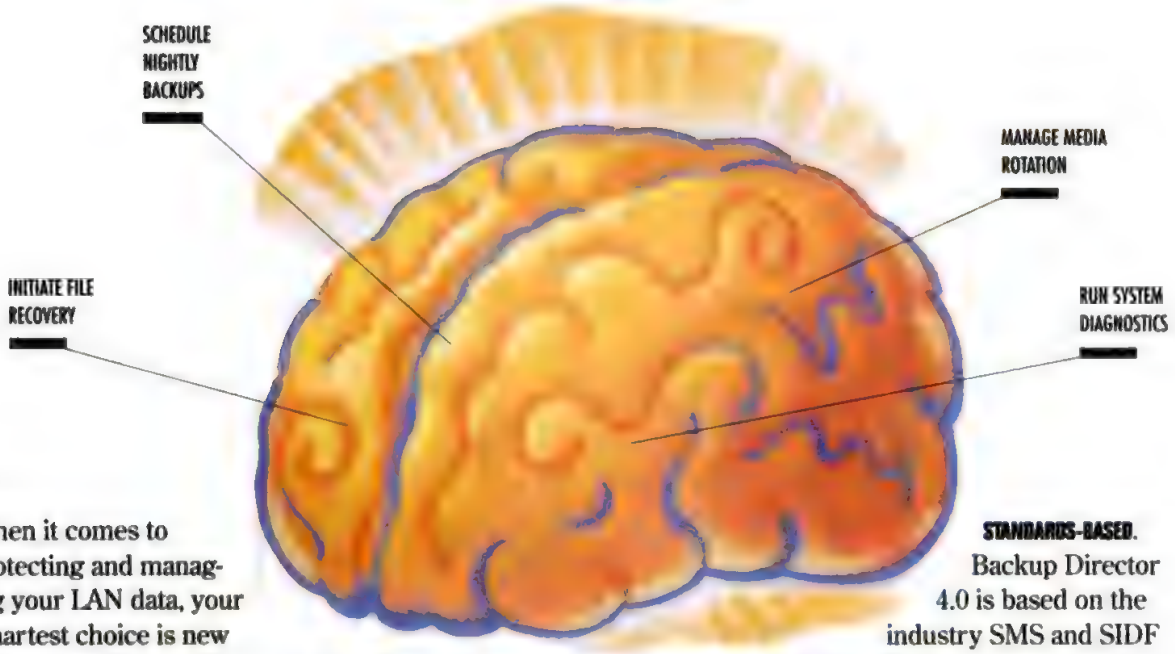

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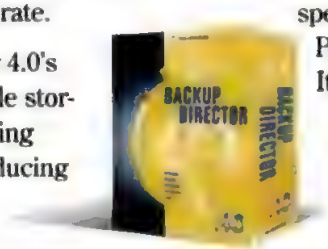

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Don't Hang Up That Cable

Great news, Frank! There's going to be more and more competition among local-access telephone service providers. Sprint Corp.—along with television cable companies Comcast, Cox, and Telecommunications Inc. (TCI)—is spearheading a move to take over the Teleport Communications Group (TCG) and form a new company called New Telco. The name gives away the game. In some cities, New Telco will literally be able to knock aside the local exchange carriers and provide dial-tone service to desktops. I think this competition will bring in hot new digital services and lower competitive prices.

TCG currently has fiber-optic telephone connections in 20 cities around the U.S. The company caters to businesses and provides fast high-speed connections between corporations and long-distance carriers. Companies already use TCG's digital connections to access frame-relay and X.25 services. TCG and Sprint together will be able to offer a complete communications service package.

David Greenfield: Cable/telco alliances will bring hot, new phone services at great prices.

The cable television companies involved in the New Telco alliance have operations in thousands of cities. TCG and TCI have already begun plans to venture into local-access telephone service. In early 1995, the two companies will run a beta test of cable telephone service in Illinois. The cable television companies will provide local-access telephone service with interconnections to the Ameritech local telephone service and to long-distance services. Voice telephone calls and the cable channels will ride over the same cable. This will demonstrate how cable phones can compete directly with regular telephone services and should shock the local telecommunications companies into providing some innovative digital services.

In the same vein, Digital Equipment Corp. is working on a technology called ChannelWorks. Digital is working with local cable companies to provide Internet access and other computer networking services over television cables.

The nifty thing is that all of these services are fully digital. Cable companies can offer ISDN, SONET, frame relay, or ATM to home and business customers over existing connections. If you need six voice lines from, say, 6 to 10 P.M., you pay only for what you need when you need it.

High bandwidth, digital, and flexible. Don't you love it, Frank?

I do agree with you that there is a lot to like about competing digital services, David, but we're a long way from getting anything more than a taste of the kind of service you're talking about. The local exchange carriers (LECs), the companies that provide the dial tone, are regulated monopolies. The underlying structure of how people pay for telephone service in most of the world is based on non-competition. In the U.S., regulators in every state set rates for local telephone services. Only a few states, including Illinois, Maryland, Massachusetts, Michigan, New York, and Washington, have encouraged local exchange competition in even the smallest ways. In most states, it isn't welcome.

Oh, yes. I haven't touched on the federal courts. Some divisions of the Department of Justice and the federal courts think they too control the LECs that were part of the Bell system. The cable television companies operate under regulation at the federal, state, and local levels. The only people really having fun in the cable business are the lawyers.

Frank Derfler: Forget cable/telco alliances. Real competition to LECs will come from wireless services.

The LECs keep very complex sets of books. It's an article of faith among the LECs and most regulators that business telephone services subsidize the residential services. The business rates, the argument goes, subsidize residential services so that the LECs can charge an affordable $5 to $6 a month for basic residential service and practically no one is phoneless. The alternative carriers argue that the subsidy is an LEC fabrication, but the spirit of low-cost universal service is potent. Phone access must be in the Bill of Rights somewhere.

Before Sprint, Digital, TCI, TCG, or any other company poses a serious challenge to the LECs' local dial-tone business, they will all need to agree on how to ensure universal service and appease echelons of regulators worried about their jobs. Does your computer's calendar go to 2005?

Clearly, the sleeper in this connection war is wireless—primarily because it has so little regulation. The first breakthrough wireless application will come from the Digital Satellite Services (DSS). Right now, the DSS folks say they will download commercial software to retail stores. But can direct downloading of software, news services, and other digital content to individual homes be far behind? If I had to bet on the real competition to the LECs, I'd bet on wireless, not cable TV. □

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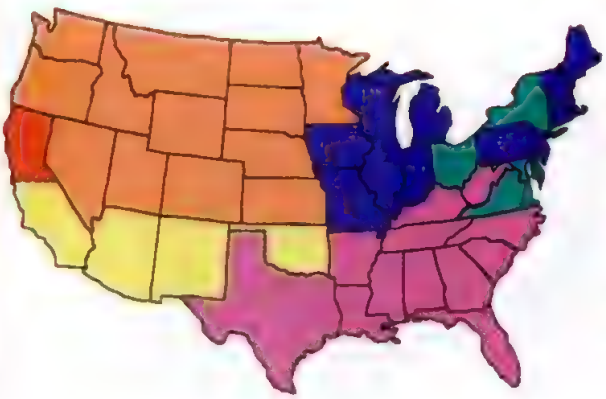

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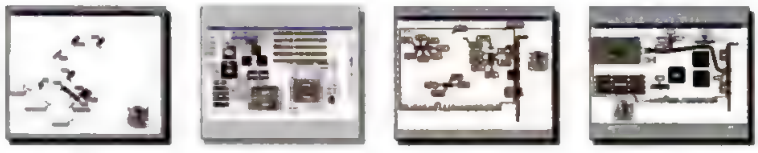

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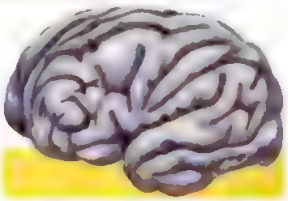

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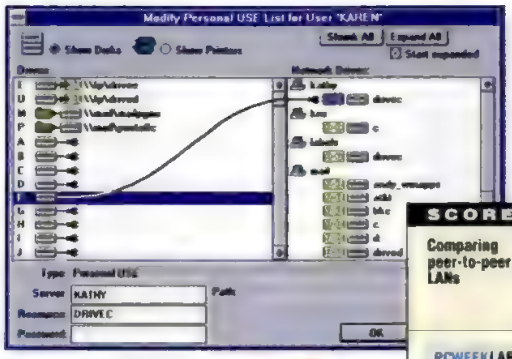

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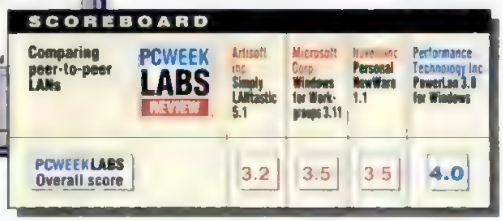

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PC Tech

The phone numbers are in the computer and the modem is attached, so why can't you dial automatically from your Lotus Notes database? You can! Learn how in our Extending Your Apps column.

User-to-User

BY NEIL J. RUBENKING

Copying Compressed Disks

Here's an easy way to save time if you need multiple copies of the same DBLSPACE-compressed floppy disk. Use DBLSPACE to create the original floppy disk, but make subsequent copies using DISKCOPY, which doesn't go through the same lengthy procedure as DBLSPACE. The target disks can be formatted or unformatted. On my 8MB 486DX2/66, DISKCOPYing a compressed floppy disk takes about half as long as using DBLSPACE.

I thought some people might find this a useful alternative to creating compressed floppy disks by rerunning DBLSPACE for each one. I've used this method often and have never had any problems, but I realize you can't recommend a probably risky process to readers.

Ronald R. Sexton
North Los Vegas, Nevada

▶**PC MAGAZINE:** On the contrary, I certainly will recommend this method for creating compressed floppy disks. When DBLSPACE compresses a disk, it calls on SCANDISK to perform a lengthy test that's appropriate before compressing a hard disk, but not a floppy disk. Testing requires more than half of the time it takes to compress a floppy disk!

Using DISKCOPY to replicate a compressed floppy disk is no more risky than using DISKCOPY on an uncompressed floppy disk. In fact, with DOS 6.2 or later, DISKCOPY can create multiple copies without rereading the original floppy disk, so repeated copies take only half as long.

Why isn't this risky? DISKCOPY works at a level below DoubleSpace, even below the DOS file system. It simply copies chunks of data directly from one disk to the other, with no notion of whether a particular chunk is part of a file, part of a directory, or not used at all. The result is a perfect copy of the original, and if the original has been compressed with DoubleSpace, the copy will be too.

If you're using disk-compression software other than DoubleSpace, it's extremely likely that this technique will work for you too. But you'll want to test it before committing important data to quick-compressed floppy disks.

A Problem with DOS 6.2's One-Pass DISKCOPY

DOS 6.2 lets you make a one-pass DISKCOPY of a high-density (1.44MB) floppy disk—with an exception: If the disk that holds your TEMP directory (as specified in the TEMP environment variable) has less than roughly 1.5MB free, the one-pass copy fails and you get the message "Diskcopy will revert to a multiple-pass copy."

DISKCOPY needs the space in your TEMP directory for a temporary copy of the floppy disk's image. Microsoft does indicate that DISKCOPY stores the image on your hard disk but fails to mention that the utility uses the directory specified by TEMP if it exists. (If you don't create a TEMP variable, DISKCOPY uses the root of C:, which usually has enough room.)

I discovered the problem because the TEMP directories on two of my machines had only 1MB free each. (One put TEMP on the host for a double-space drive, and the other put TEMP on a RAM drive.) So, if you're having trouble with this new DOS feature, check your TEMP variable.

Gerald C. Dorman
via ZiffNet

▶**PC MAGAZINE:** DISKCOPY's golden age came several years ago. At the time, it could make one-pass copies by loading the complete contents of a floppy disk into memory—few disks were larger than 360K, and many machines had a whopping 512K or more of RAM. Adept hackers even patched DISKCOPY to make multiple copies from the in-memory image without rereading the floppy disk. The arrival of 720K, 3.5-inch floppy disks heralded the end of this age, and high-density 1.2MB and 1.44MB floppy disks (which held more data than the entire 1MB of conventional memory) banished it utterly.

DOS 6.2 ushers in the DISKCOPY

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renaissance. You can now copy floppy disks of any size without repeated disk swapping, because DISKCOPY puts an image of the floppy disk's data in a temporary file on the hard disk. And, without any patching or trickery, DISKCOPY makes multiple copies after reading the source just once, which speeds the process substantially—that is, as long as free space on the TEMP directory's drive remains greater than the capacity of the floppy disk being copied.

DOS 6.2's HELP program does mention that the temporary copy of the floppy disk's data gets put into the directory specified by TEMP, but HELP doesn't state what can happen as a result.

Increasing the Size of Windows' Swap File

Here's a tip that could help if, when you try to make more virtual memory available, Microsoft Windows 3.1 won't let you raise the size of your permanent swap file. In the New Settings box of the Virtual Memory dialog (accessed through Control Panel's 386 Enhanced icon), specify Type as None. This will delete any existing (or previous) swap file. Then, before you create a new one, defragment your hard disk to make the free space contiguous. Now Windows will let you make your new swap file as big as the available contiguous disk space.

This is necessary because Windows, when attempting to determine a Recommended Size for the permanent swap file, looks on your hard disk for an existing swap file bounded by used clusters. If found, Windows uses the existing file's size as the Recommended Size—even if there's a larger block of free contiguous empty space elsewhere on the disk! You might, for example, have 30MB of open, contiguous disk space, but if you already have a 2MB swap file, *and* other files use the clusters immediately before and after it, Windows will insist on keeping the swap file at 2MB.

Since making this accidental discovery (the Windows manual gives only vague information about what's going on, but the Developer's kit does better), I've been able to boost the sizes of permanent swap files on various systems by 8 or 9MB, resulting in better Windows performance on those systems.

Jon Woolf
via ZiffNet

►**PC MAGAZINE:** The Windows permanent swap file is used to create virtual memory in 386 Enhanced mode, effectively giving your system more memory. If Windows runs out of actual memory, it will copy data from a block of memory to the swap file and then reuse the same memory block. Later, when a program requests the original data, Windows copies a different (and currently unneeded) block of data to the disk and copies the first block back into memory—thus *swapping* the data in physical memory with that stored on disk; hence, the name *swap file.*

There's one minor catch: Although reading from memory is one of the fastest things a computer does, reading from hard disk is one of the slowest. Worse yet, in the file system used by DOS and Windows, a file's data can be scattered in many areas of the disk, linked by entries in the FAT (file allocation table). Reading a file involves laboriously tracing through the FAT to find all the pieces. To make swapping as fast as possible, Windows avoids the normal FAT-based file access by insisting that the permanent swap file exist in one continuous block on the disk. The file 386SPART.PAR resides in the root directory of the selected drive. You don't see it in normal directory listings, since its attributes are set to Hidden and System.

Windows for Workgroups is fast becoming the de facto current version of Windows.

If your hard disk is nearly full (and whose isn't?), your Windows permanent swap file is almost certainly bounded fore and aft by clusters of disk space in use by other files. When you attempt to expand the swap file, Windows only lets you expand into free space that's continuous with the existing swap file. It would be smarter if Windows checked for the possibility of a larger block of continuous unused space elsewhere on the disk, but since it doesn't, you'll do well to follow the advice in this tip. Open the 386 Enhanced applet in Control Panel, press the Virtual Memory button, change the swap file type to None, and exit Windows. Now defragment the disk, restart Windows, and reestablish the swap file at the desired size.

Keep Windows Install Files Handy

Your issue of September 13, 1994 presented an excellent suggestion on copying the Windows installation disks to your hard disk. An important point was missed, though, that should be mentioned: Windows for Workgroups includes a section in WIN.INI specifically for the location of original disks. In the section [winsetup] there is a single key named source_disk_path, which can be set to any location, including local hard disk or network hard disk, like this:

```
[winsetup]
source_disk_path=C:\WINDISKS
```

You can keep the set-up files on the network server and at the same time allow users to add printers or change video settings without having to worry about the original floppy disks.

Russ Cooper
via Internet

►**PC MAGAZINE:** Windows for Workgroups is fast becoming the de facto current version of Windows. Most new systems come with it installed, rather than Windows 3.1. The main advantage to using Windows for Workgroups is its network support, but there are a number of benefits for the non-networked system, including the `source_disk_path` setting mentioned here. For example, File Manager and Print Manager gain handy toolbars, and the new ClipBook Viewer lets you save and share items on the clipboard. It's probably not worth your while to upgrade a non-networked system to Windows for Workgroups, but you should request it on any new systems. □

Tutor

BY JEFF PROSISE

Identifying CPUs Through Software

A few years ago I published a small program called WHATCPU, which identifies the type of processor chip installed in your PC. In recent months, I've received several letters and e-mail notes from readers asking me to update WHATCPU so that it recognizes Pentium processors. The last version doesn't recognize anything higher than an 80486 because it was written long before the Pentium processor chip made its debut.

Because of your feedback, a new and improved version of WHATCPU is now available in the Utilities/Tips Forum of PC MagNet. Look for WHATCP.ZIP in the Tutor library. If you're modemless, you can create WHATCPU on your own by typing in the DEBUG script shown in Figure 1. When executed, WHATCPU displays a short message on the screen identifying the CPU type. Not surprisingly, "It's a 486!" means WHATCPU is running on a 486 machine. WHATCPU doesn't attempt to distinguish between the different flavors of the same chip—for example, the SX, DX, DX2, and DX4 versions of the 80486—because it's difficult to do so reliably, and the information usually isn't important to programs anyway.

Writing software that distinguishes among processor types is an interesting exercise, because it highlights some of the subtle differences among the various members of Intel's *x*86 family. In order to understand how WHATCPU works, let's briefly discuss the *x*86 microprocessor family and the techniques used to distinguish one family member from another through software. As you read along, you may find it helpful to refer to WHATCPU's source-code listing in Figure 2 and the outline of the logic that WHATCPU uses in Figure 3.

THE 8086 AND 8088 The 8086 processor chip and its sibling the 8088 were used in early IBM PCs and compatibles. The two chips were identical except for the widths of their external interfaces. The 8086 featured 16 data lines, providing a 16-bit interface to the data bus. The 8088, by contrast, had only 8 data lines and therefore communicated with the data bus through an 8-bit interface. The practical implication of this was that an 8086 operated slightly faster because it could move an entire 16-bit word on or off the data bus in one operation. To accomplish the same task, an 8088 required two operations of 1 byte (8 bits) each. Functionally, however, the two processors were identical. Each used the same instruction set, and each contained 20 address lines permitting the processor access to up to 1MB of memory.

Identifying an 8086 or 8088 CPU through software is easy. All members of the *x*86 family contain a FLAGS register, or short-term storage location, which holds a series of bit flags identifying processor states. Bits 12 through 15 of the FLAGS register are always set (always contain 1 rather than 0), no matter how creative you are at trying to clear them (or make them 0). WHATCPU attempts to set bits 12 and 14 and clear bits 13 and 15 utilizing a sequence of instructions copying register values to and from the stack mixed with AND and OR instructions. If bits 12 through 15 remain set, then the processor must be an 8086 or 8088, and the program branches accordingly.

THE 80286 The next member of the *x*86 family after the 8086 and 8088 was the 80286, which was first used in the IBM PC/AT. (Actually, Intel introduced two more members of the family, the 80186 and 80188, before the 80286. However, these processors were used primarily to build specialized controllers and saw only very limited use in PCs.) The chief enhancements offered by the 80286 were protected mode and the addition of 4 new address lines, bringing the total number of address lines to 24. Together, these enhancements enabled the CPU—and software running on it—to access up to 16MB of memory.

Bits 12 through 15 of the FLAGS register can also be used to identify an 80286. Whereas these bits are always set on an 8088 or 8086, they are always clear on an 80286 running in real mode. If the test for an 8086/8088 fails because bits 12 through 15 are not set, WHATCPU immediately checks to see if the bits are clear. If they are, then the processor must be an 80286.

THE 80386 The 80386 further expanded the memory-addressing capabilities of

```
N WHATCPU.COM
E 0100 EB 62 49 74 27 73 20 61
E 0108 6E 20 38 30 38 36 20 6F
E 0110 72 20 38 30 38 38 21 0D
E 0118 0A 24 49 74 27 73 20 61
E 0120 20 32 38 36 21 0D 0A 24
E 0128 49 74 27 73 20 61 20 33
E 0130 38 36 21 0D 0A 24 49 74
E 0138 27 73 20 61 20 34 38 36
E 0140 21 0D 0A 24 49 74 27 73
E 0148 20 61 20 50 65 6E 74 69
E 0150 75 6D 21 0D 0A 24 49 74
E 0158 27 73 20 61 20 3F 38 36
E 0160 21 0D 0A 24 BA 02 01 FA
E 0168 9C 9C 58 25 FF 0F 0D 00
E 0170 50 58 9D 9C 58 9D FB 25
E 0178 00 F0 3D 00 F0 75 03 E9
E 0180 93 00 BA 1A 01 0B C0 75
E 0188 03 E9 89 00 BA 20 01 FA
E 0190 66 9C 66 9C 66 58 66 8B
E 0198 D8 66 35 00 00 04 00 66
E 01A0 50 66 9D 66 9C 66 58 66
E 01A8 9D FB 66 25 00 00 04 00
E 01B0 66 81 E3 00 00 04 00 66
E 01B8 3B C3 0F 84 57 00 BA 36
E 01C0 01 FA 66 9C 66 9C 66 58
E 01C8 66 8B D8 66 35 00 00 20
E 01D0 00 66 50 66 9D 66 9C 66
E 01D8 58 66 9D FB 66 25 00 00
E 01E0 20 00 66 81 E3 00 00 20
E 01E8 00 66 3B C3 0F 84 25 00
E 01F0 66 B8 01 00 00 00 0F A2
E 01F8 66 25 00 0F 00 00 66 C1
E 0200 E8 08 BA 44 01 66 83 F8
E 0208 05 0F 84 08 00 04 30 A2
E 0210 5D 01 BA 56 01 B4 09 CD
E 0218 21 B4 4C CD 21
RCX
11D
W
Q
```

Figure 1: **This DEBUG script creates WHATCPU.COM. To execute the script, enter the commands into a text file named WHATCPU.SCR, and type DEBUG <WHATCPU.SCR.**

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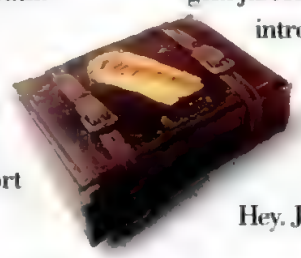

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```
;*************************************************************************
; WHATCPU identifies the type of CPU that it is run on.
;*************************************************************************

CPUID       MACRO
            db      0Fh,0A2h            ;Macro for CPUID instruction
ENDM

code        segment
            assume  cs:code,ds:code
            org     100h
begin:      jmp     short main

msg_8086    db      "It's an 8086 or 8088!",13,10,"$"
msg_286     db      "It's a 286!",13,10,"$"
msg_386     db      "It's a 386!",13,10,"$"
msg_486     db      "It's a 486!",13,10,"$"
msg_586     db      "It's a Pentium!",13,10,"$"
msg_other   db      "It's a ?86!",13,10,"$"

main            proc    near
;
; Check for an 8086 or 8088 by attempting to clear bits 12 to 15 of the
; FLAGS register. On an 8086 or 8088, these bits are always set.
;
            mov     dx,offset msg_8086  ;Assume 8086/88
            cli                         ;Interrupts off
            pushf                       ;Save FLAGS
            pushf                       ;Push FLAGS on stack
            pop     ax                  ;Pop FLAGS into AX
            and     ax,0FFFh            ;Clear bits 12 to 15
            or      ax,5000h            ;Set bits 12 and 14
            push    ax                  ;Push AX on stack
            popf                        ;Pop AX into FLAGS
            pushf                       ;Push FLAGS on stack
            pop     ax                  ;Pop FLAGS into AX
            popf                        ;Restore FLAGS
            sti                         ;Interrupts on
            and     ax,0F000h           ;Clear bits 0 to 11
            cmp     ax,0F000h           ;Are bits 12 to 15 set?
            jne     check_286           ;No, then it's a 286 or higher
            jmp     done                ;Yes, then it's an 8086/88
;
; Check for a 286 by seeing if bits 12 to 15 are clear after the
; previous operation. On a 286 running in real mode, these bits are
; always clear.
;
check_286:  mov     dx,offset msg_286   ;Assume 286
            or      ax,ax               ;Are bits 12 to 15 clear?
            jne     check_386           ;No, then it's a 386 or higher
            jmp     done                ;Yes, then it's a 286
;
; Check for a 386 by attempting to toggle the EFLAGS register's
; Alignment Check (AC) bit. This bit cannot be changed on a 386.
;
            .386

check_386:  mov     dx,offset msg_386   ;Assume 386
            cli                         ;Interrupts off
            pushfd                      ;Save EFLAGS
            pushfd                      ;Push EFLAGS on stack
            pop     eax                 ;Pop EFLAGS into EAX
            mov     ebx,eax             ;Store EAX in EBX
            xor     eax,40000h          ;Toggle bit 18
            push    eax                 ;Push EAX on stack
            popfd                       ;Pop EAX into EFLAGS
            pushfd                      ;Push EFLAGS on stack
            pop     eax                 ;Pop EFLAGS into EAX
            popfd                       ;Restore EFLAGS
            sti                         ;Interrupts on
            and     eax,40000h          ;Clear all but bit 18
            and     ebx,40000h          ;in EAX and EBX
            cmp     eax,ebx             ;Compare EAX and EBX
            je      done                ;If equal, then it's a 386
;
; Check for a 486 by attempting to toggle the EFLAGS register's ID bit.
; This bit cannot be changed on *most* 486s.
;
            mov     dx,offset msg_486   ;Assume 486
            cli                         ;Interrupts off
            pushfd                      ;Save EFLAGS
            pushfd                      ;Push EFLAGS on stack
            pop     eax                 ;Pop EFLAGS into EAX
            mov     ebx,eax             ;Store EAX in EBX
            xor     eax,200000h         ;Toggle bit 21
            push    eax                 ;Push EAX on stack
            popfd                       ;Pop EAX into EFLAGS
            pushfd                      ;Push EFLAGS on stack
            pop     eax                 ;Pop EFLAGS into EAX
            popfd                       ;Restore EFLAGS
            sti                         ;Interrupts on
            and     eax,200000h         ;Clear all but bit 21 in
            and     ebx,200000h         ;EAX and EBX
            cmp     eax,ebx             ;Compare EAX and EBX
            je      done                ;If equal, then it's a 486
;
; We succeeded in toggling the processor's ID bit, so it's probably a
; Pentium or higher. But it *could* be a 486, so be careful. To
; identify the processor, use the family ID code returned by the CPUID
; instruction.
;
            mov     eax,1               ;Get CPU ID information
            CPUID                       ;via the CPUID instruction
            and     eax,0F00h           ;Clear all but bits 8 to 11
            shr     eax,8               ;Shift right 8 places
                                        ;(EAX = Family ID)

            mov     dx,offset msg_586   ;Assume Pentium
            cmp     eax,5               ;Is the family ID 5?
            je      done                ;Yes, then it's a Pentium

            add     al,30h                      ;It's not a Pentium,
            mov     byte ptr msg_other[7],al    ;so report the family
            mov     dx,offset msg_other         ;ID directly
;
; Display the processor type and terminate.
;
done:       mov     ah,09h              ;Display "It's a ..."
            int     21h                 ;message
            mov     ah,4Ch              ;Terminate via DOS
            int     21h                 ;function 4Ch
main        endp

code        ends
            end     begin
```

Figure 2: **This is the assembly language program listing for WHATCPU.COM.**

the *x*86 line and also introduced a new operating mode known as Virtual-86 (V86) mode. The 80386's 32 address lines allowed it to read and write up to 4 gigabytes of memory, which is a lot of RAM even by today's standards. V86 mode enabled older programs, notably the tens of thousands of applications written for DOS, to run in real-mode-like virtual machines (VMs) alongside protected-mode applications. V86 mode allows DOS applications to be executed and multitasked in Windows' 386 Enhanced mode, and it forms the foundation for the operation of 80386 memory managers such as 386MAX, QEMM-386, NetRoom, and EMM386.EXE.

The 80386 came in two flavors: a DX version and an SX version. The 80386SX contained only 24 address lines compared with the 80386DX's 32, limiting the former to addressing 16MB of physical memory. (Internally, the SX, like the DX, could handle up to 4GB of virtual memory. So from a software standpoint, the two were still identical.) The only other major difference between the two was the width of their interfaces to the data bus: 32 bits for the 80386DX and 16 for the 80386SX. Other, more specialized versions of the 80386 were offered by Intel, IBM, and others, but fortunately these were functionally identical to the SX and DX versions and largely indistinguishable through software.

As is the case with the 8086, the 8088, and the 80286, the processor flags hold the key to identifying an 80386 CPU. The FLAGS register was expanded from 16 to 32 bits on the 80386 and renamed EFLAGS. Bit 18 of the EFLAGS register was undefined and could not be set. This bit became the Alignment Check (AC) bit on the 80486 and is used to trap misaligned memory accesses—for example, attempts to read a word from an address that lies on a byte boundary. WHATCPU reads the EFLAGS register and tries to toggle the AC bit. If the bit's value can't be changed, WHATCPU concludes that the machine is a 386 and responds accordingly.

THE 80486, PENTIUM, AND BEYOND

The 80486 improved upon the 80386 line by introducing a series of incremental archi-

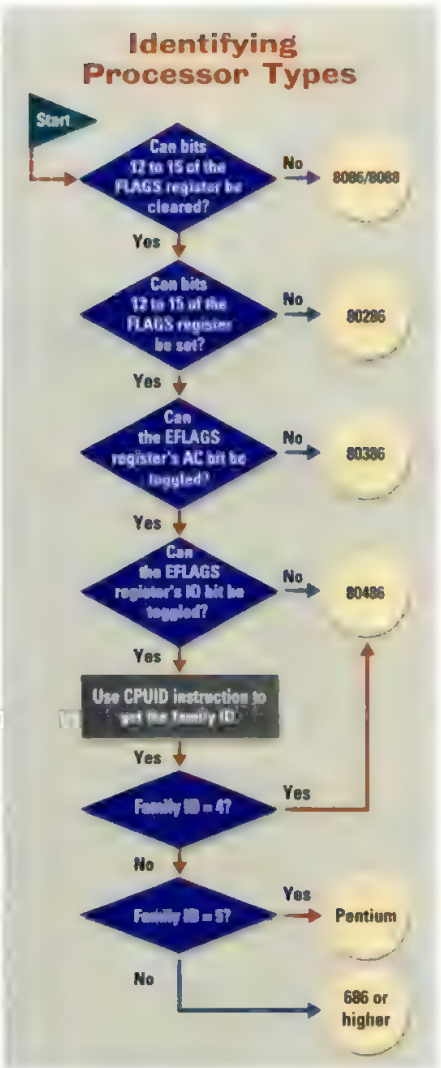

Figure 3: **This flowchart outlines the steps required for a program to identify the CPU it is running on and highlights some of the subtle differences among the various members of the Intel *x86* family.**

tectural enhancements designed to boost performance. Among other things, the 80486 boasts an on-chip unified code and data cache composed of fast static RAM. The DX version of the chip also contains an integrated math coprocessor, or floating-point unit (FPU). The 80486SX is equivalent to an 80486DX with the FPU disabled, while the more recent 80486DX2s and 80486DX4s are DX-class 80486s that use clock-multiplying technology to improve performance. (For an overview of clock multiplying and its use in 80486s and other modern-day microprocessor chips, see the Tutor column in our June 28, 1994, issue.) The Pentium, of course, is the latest and most powerful entrant into the *x*86 family. It, too, builds upon the basic 80386 architecture to produce a faster-running chip. Its many enhancements include a 64-bit interface to the data bus, superscalar architecture (meaning it can execute two instructions at the same time), separate 8K code and data caches, and a pipelined FPU.

Once the 8086, the 8088, the 80286, and the 80386 chips have been ruled out, a program can distinguish 80486SX, 80486DX, and 80486DX2 CPUs from 80486DX4 and Pentium CPUs by trying to toggle bit 21 of the EFLAGS register. This bit is known as the ID bit on the 80486DX4 and Pentium, but it is undefined on other 80486s. Both the 80486DX4 and the Pentium support a new microprocessor instruction called CPUID that returns identification information about the CPU. An ID bit whose value can't be changed is a sure sign of an 80486 CPU. WHATCPU attempts to toggle this bit and reports that the machine is based on an 80486 processor if the bit resists efforts to change it. If, however, the ID can be toggled, further tests must be performed to determine whether the processor is an 80486DX4, a Pentium, or perhaps a later-generation Intel CPU.

When called with register EAX holding the value 1, the CPUID instruction returns information in EAX identifying the CPU's step level (analagous to a version number for software), model, and family. The term *family* here doesn't mean the *x*86 family; it means the 80486, the Pentium, and so on. The family ID code is contained in bits 8 through 11. To separate Pentiums from other CPUs, WHATCPU executes a CPUID instruction and examines the resultant family ID code. A value of 5 identifies a Pentium, while a value of 4 identifies an 80486. Specifically, a 4 identifies an 80486DX4, since earlier 80486s do not support the CPUID instruction.

Presumably, future CPUs will return other family IDs. For compatibility with as-yet-undeveloped Intel CPUs, WHATCPU displays the family ID code followed by "86" when it encounters a family ID other than 4 or 5. Assuming the 80686 (or the Hexium, or whatever Intel chooses to call the successor to the Pentium) will return a family ID of 6, WHATCPU will automatically report it as an 80686; no further software updates should be required. □

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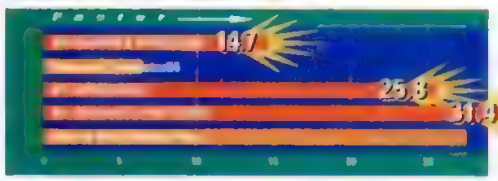

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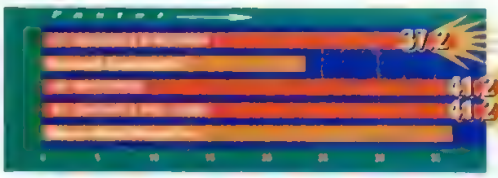

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CIRCLE 127 ON READER SERVICE CARD

Extending Your Apps

BY BRIAN PROFFIT

Making Notes More Noteworthy

According to figures from Lotus Development Corp., nearly a million people are experiencing the joys of groupware via Lotus Notes. There can be no doubt that Lotus has created a new category of application and one for which the market has found good use.

Notes brings with it some old baggage, though. The interface you use to develop Notes applications is based loosely on the same macro language used by Lotus 1-2-3 over a decade ago. Admittedly it has been extended quite a bit since then, but it is still clearly designed to make it easy for Lotus to interpret your instructions rather than being easy for you to write them. Fortunately, Lotus provided a back door through which you can make a connection with external programs. That can make it easier for anyone to enhance their Notes applications.

WHY DO I CARE? Despite its richness, the Notes interface is designed to provide "behind the scenes" processing of your information, rather than letting the aggressive user expand his application into more graphical or interactive functions. For example, one of the most common uses of Notes is to maintain a database of people—whether customers, contacts, or vendors.

The need for databases like this has been clear for years, and Notes has helped make them more visually usable and sharable—even across operating platforms—than ever before. On the other hand, how many people would buy a Personal Information Manager (PIM) these days that didn't provide an auto-dialer? (I won't argue the social aspects of people becoming so accustomed to changing television channels without leaving their chair that the act of pushing the phone buttons is an annoyance.)

The phone numbers are in the computer, and the modem is attached, so why not get the extra productivity? Notes doesn't provide an interface to allow all of those people-oriented databases to connect to the telephone. But we have our ways. . . .

Fortunately, Lotus provided a back door through which you can make a connection with external programs. That can make it easier to enhance Notes Applications.

@ YOUR COMMAND The secret is the @command function. This function can instantly transfer control to any program you want and, in a limited way, send that program some data. Let's take a look at how you can use this function to add auto-dial capability to your existing Notes applications.

Open a contact-related Notes application (for which you have Designer privileges), and select the menu option Design | Forms to bring up a list of the forms defined for that database. Select a form that shows an individual's name and phone number, and click on Edit. Move the cursor down to the end of the field containing the phone number. Now tab to the right, and select the menu option Edit | Insert | Button. Notes will respond with the button assignment dialog, and your screen will look similar to Figure 1.

As you can see, we've put the word "Dial" onto the button to indicate its purpose. The formula that is executed when the button is pressed needs a little more explanation.

ASSIGNING A PROGRAM TO THE BUTTON The main purpose of the @command function is to execute options from the Notes menus as if the user had performed the selection. The argument inside the square brackets indicates the menu item to perform. In this case, though, we've activated the Notes back door by specifying that we want to execute the next argument as if it were typed at a command line.

Note that the backslash (\) is used by Notes to indicate things like cascaded menus, so in order to describe the path to the program, you must use double backslashes to specify subdirectories. We'll build the dialing program shortly.

The third argument defines the parameters to be sent to the program as if they were typed after the program name on the command line. Because of the limitations of Lotus's command interpreter, though, Notes officially only supports a string constant here, such as the name of a file the designated program should load. But we want to send the program data from our application—the phone number we want to dial.

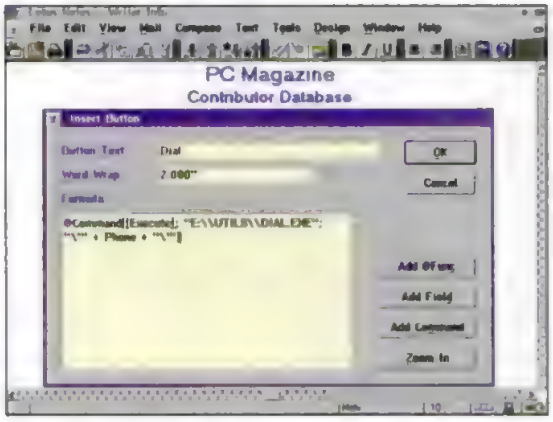

Figure 1: You assign characteristics to a button on a Notes form through this dialog box.

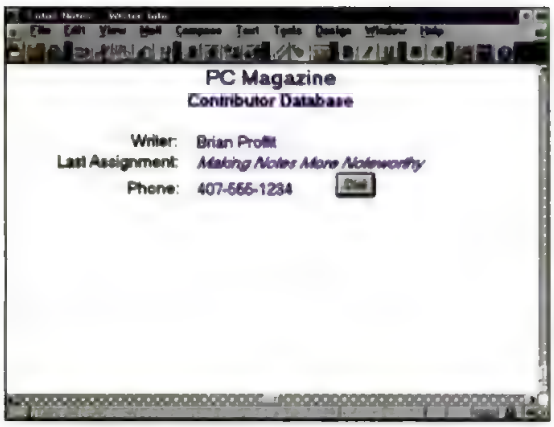

Figure 2: **The Dial button adds an easy auto-dial function.**

The convoluted string in Figure 1 allows us to circumvent Notes' limitation. The first part is a quotation mark, a backslash, an apostrophe, and another quotation mark. I said earlier that Notes treats the backslash as a special character. In this case, it marks the start of a string and allows more characters to be concatenated to the string. If you were passing a constant phone number, you would simply put it between quotation marks without using the backslash, that is "800-555-1212." The backslash tells Notes that a field's value rather than a constant will be inserted into the string.

The apostrophe acts as the opening delimiter of the parameter to be passed. Whatever appears between the apostrophes (after the field values have been inserted) will be treated as if it were a constant string. Next, we concatenate Phone, the name of the field whose contents we want to send to the program. Finally, we terminate this with another quotation mark, a backslash, an apostrophe to end the phone-number string, and a final quotation mark to end the argument. Hey, if it were easy you wouldn't need to read *PC Magazine* to find out how to do it.

You can extend this technique to pass more than one value to your program. Suppose we also wanted to pass the writer's name to appear in the message box. We could do so by making the third argument:

```
"\'' + Phone + ',' + WriterName +
 "\'"
```

The program would then receive the two fields separated by a comma so they could be pulled into different variables.

That's all there is to it on the Notes side. Click on OK to accept the button, and then press Escape to get out of edit mode. If you have a form of this type open, you will have to close it and reload before your changes will be seen. You should then have a screen similar to that in Figure 2.

Note: There was a bug in Notes 3.1.5 for OS/2 that caused it not to pass arguments to the program being executed, so this technique will not work with that version. It does work, however, with earlier and later versions of the OS/2 software and with all versions of Lotus Notes for Windows.

PROCESSING THE PHONE NUMBER Now we need to create a program to actually dial the phone. The program must have some level of interactivity, too. It must tell users when to pick up the handset, it must prompt them to indicate that they have done so, and then it must hang up the modem line. When you call your parents, do they both get on different extensions to talk to you? The voice quality of both suffers then. We need to hang up the modem so that your handset won't suffer the same problem.

This is all a bit awkward to do from a batch file, and it requires the operating system to start a command session. And it's ugly and confusing to many users, particularly under Windows if you haven't changed the default to a windowed session and your Windows desktop disappears. It's much smoother to write a quick program that allows everything to appear to the user as a natural part of Notes. Besides, this gives us a chance to dress up the entire process and make it look professional.

We'll write this program using Microsoft Visual Basic for the Windows people and using Watcom VX-REXX for the OS/2 world. The technique is remarkably similar regardless of the tool being used: In fact, the first part of the task is essentially identical, as you can see in Figure 3.

We've created a small dialog box as the only form in the application. The large blank area on the left side of the form is used to fancy things up a bit—it is a bitmap space that I've assigned to an icon of a telephone. VX-REXX doesn't show the bitmap until the program is run. I've broken the top line of text into two parts: one with the words "Connecting with" and a second text field where I'll plug in the telephone number when the program is run. Remember to define the first text field as right-justified so the words run together like a normal sentence when the phone number is put into the second field. The second line instructs the user to pick up the handset and then close the dialog. That's important, because that's the key for the program to hang up the modem. There is a standard push button at the bottom of the dialog. This button has been defined

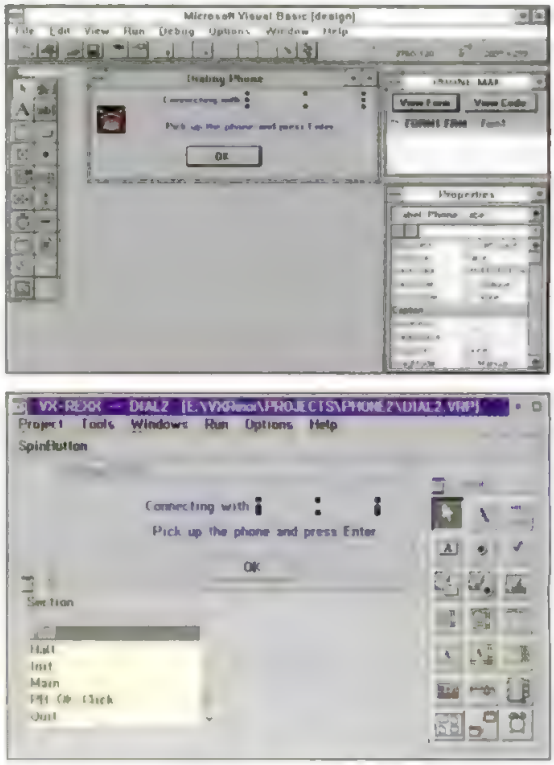

Figure 3: **The first step in creating a dialog is essentially the same in Visual Basic (top) as it is in VX-REXX (bottom).**

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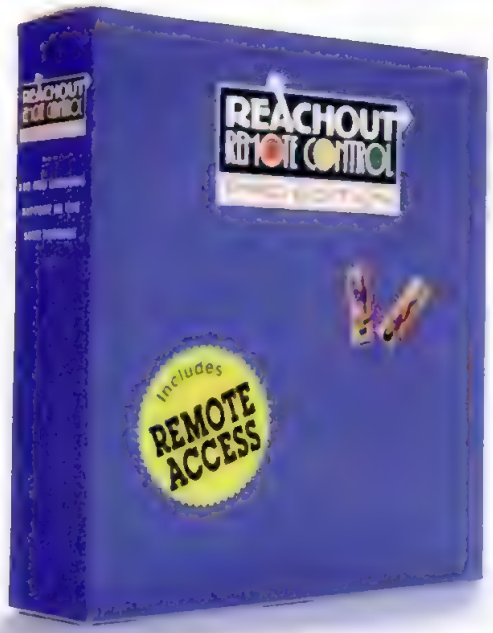

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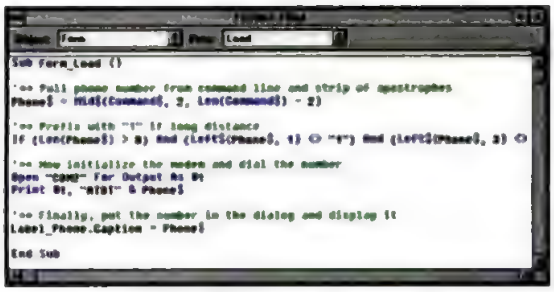


***Figure 4:* This Visual Basic code is attached to the form.**

as the default action, so either pressing Enter or clicking on the button will close the dialog.

Also, we want this to appear as a modal dialog to Notes itself. It is typical to remove the minimize and maximize icons from that type of window, as I've done here. I've also changed the window's border from the normal thick, sizable frame to a thin, fixed-size frame. One other change I've made in the Properties window is to set the ControlBox to False in Visual Basic and uncheck the System Menu box in VX-REXX. This forces the user to click on the push button to trigger hanging up the modem. You can see these changes with VX-REXX, but Visual Basic doesn't show them until the program is run.

ASSIGNING CODE TO THE FORM The program steps that need to be attached to the form are naturally not quite the same in Basic and REXX. Let's look at the Windows side first. Double-click on a blank area of the form to define instructions to be executed before the dialog is displayed, as shown in Figure 4. Starting on the line under the Sub Form_Load () statement, enter the instructions shown in Figure 5. (Note that the numbers at the start of each line are for illustration purposes only and should not be entered. The lines that begin with an apostrophe are comments and may be entered but are not necessary.)

Visual Basic automatically puts any arguments passed to it from the command line into the predefined variable Command$. Line 2 extracts the phone number from Command$, removing the apostrophes we had to put around the number in Notes. Line 3 checks to see if this is a long-distance number. If it is, Line 3 checks to see if there is already a "1" at the front of the number or an "011" for international calls. If needed, line 3 will prefix a "1" to the front of the number. Line 4 opens the communications port so that we can send commands to the modem. If your modem is on a port other than COM2, change the line accordingly. Line 5 does the actual dialing, sending the modem command to take the line off hook, wait for a dial tone, and then dial the number. Note that if you don't have Touch-tone phone capability, you should change the command to "ATDP" for pulse dialing. Finally, line 6 copies the phone number into the blank field on the form so it will appear in the dialog. If you named the blank field something other than Label_Phone, use the appropriate object name.

We're halfway home; we just need to process the Enter push button press and end the program. Move to the top of the code window, and change from the Form object to whatever you named the push button and the Click procedure. Insert the following instructions (again, without the line numbers):

```
1 Print #1, "ATH"
2 Close #1
3 End
```

The first line sends the modem a command to hang up the phone. Don't worry, your handset will stay connected. The second line closes the communications port, and the third line tells Visual Basic to end the program. Now save your project, and select the option from the File menu to create an .EXE file. Be sure to use the same name that you used in the Notes @Command statement.

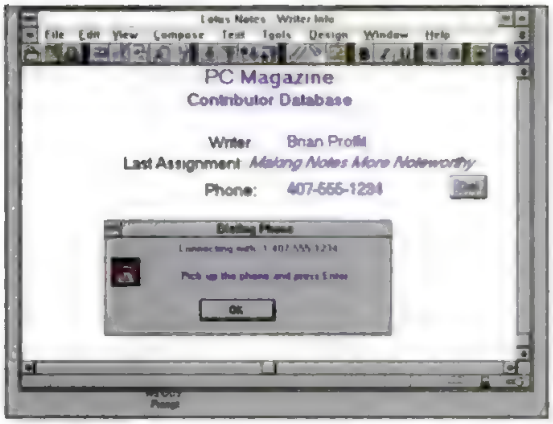


***Figure 6:* After you've attached code to the form, you can dial automatically from your Notes database.**

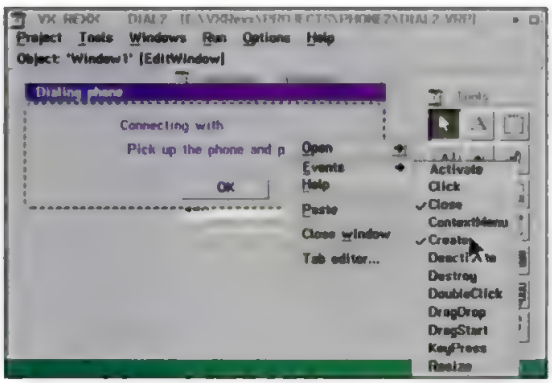


***Figure 7:* In VX-REXX you assign code to the form using this pop-up menu.**

```
'** Define variables
 1 Dim Phone$
'** Pull phone number from command line and strip of apostrophes
 2 Phone$ = Mid$(Command$, 2, Len(Command$) - 2)
'** Prefix with "1" if long distance
 3 If (Len(Phone$) > 8) And (Left$(Phone$,1) <> "1") And (Left$(Phone$,3) <>
"011") Then Phone$ = "1-" & Phone$
'** Now initialize the modem and dial the number
 4 Open "COM2" For Output As #1
 5 Print #1, "ATDT" & Phone$
'** Finally, put the number in the dialog and display it
 6 Label_Phone.Caption = Phone$
```

***Figure 5:* This is the Visual Basic code for dialing the telephone.**

That's all there is to it! Now go back to Notes, and open a form containing the new Dial button. Click on the button, and listen for the dial tone as your system responds, as shown in Figure 6.

VX-REXX IS JUST AS EASY OS/2 users will find the VX-REXX code just as straightforward as the Visual Basic effort

was. Click with the right mouse button on an empty area of the form to bring up the form's pop-up menu. Click on the arrow beside Events for a list of the event that can occur on the form, as shown in Figure 7.

Click on Create in order to open a window to enter the instructions to execute before the dialog is displayed. Move to the line underneath the Window1_Create label, and insert the instructions (without the line numbers) shown in Figure 8.

VX-REXX copies command line arguments into a compound variable named InitArgs. Line 1 extracts the phone number and strips the apostrophes. Lines 2 through 4 are almost exactly the same as their Visual Basic counterparts and handle the same long-distance checking and phone-dialing functions. Line 5 puts the phone number into the empty text area of the dialog. If your modem is attached to a serial port other than COM2 or you named the text field something other than DT_Phone, you will need to adjust the program accordingly.

Now finish the program by adding the code to execute when the push button or the Enter key is pressed. Right-click on the push button to bring up its pop-up menu, and select the Click event. Move the cursor to the line underneath the OKButton_Click label, and insert the following instructions (without line numbers):

```
1 call LineOut 'COM2', 'ATH'
2 call Stream 'COM2', 'C', 'Close'
3 exit
```

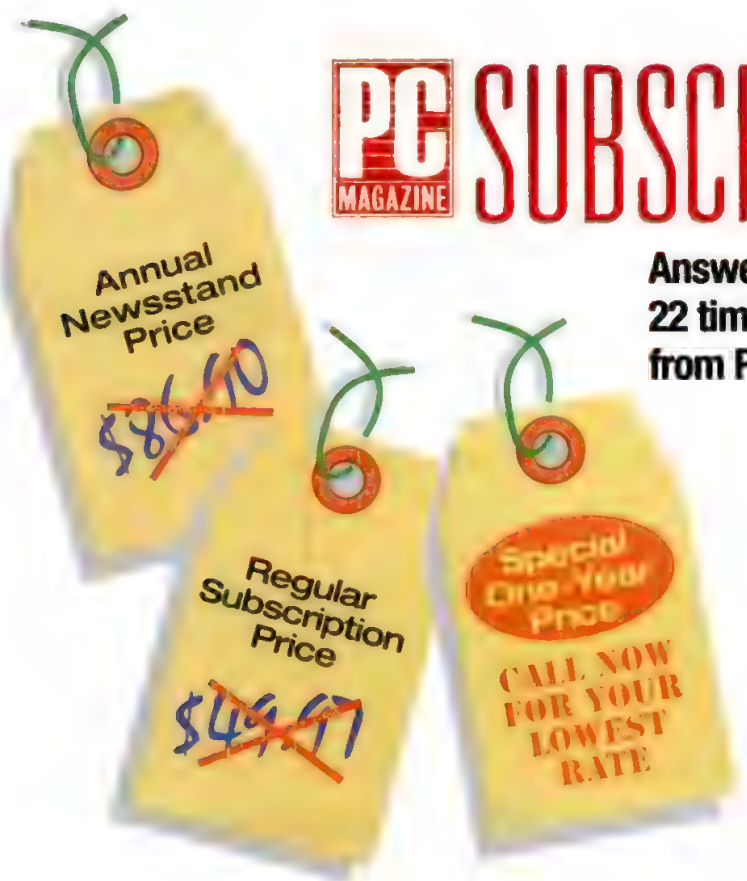
These lines correspond exactly to their Visual Basic counterparts to hang up the modem, close the serial port, and end the program. Now save the project, and create an executable file with the same name you used in the Notes @command function. The results will be exactly the same as those in Figure 6.

LET YOUR IMAGINATION RUN This example adds a very valuable function to your Notes database, but it's only the beginning. Now that you know how to assign a program to a push button and pass data to the program from your Notes form, you can probably come up with dozens of ways to make Notes even more valuable for you. □

```
1 Phone = Strip(InitArgs.1,, "'")
2 If Length(Phone) > 8 & Left(Phone,1) <> '1' & Left(Phone,3) <> '011' then
Phone = '1-' || Phone
3 call Stream 'COM2', 'C', 'Open'
4 call LineOut 'COM2', 'ATDT' || Phone
5 call VRSet 'DT_Phone', 'Caption', Phone
```

Figure 8: **This is the VX-REXX code for dialing the telephone.**

BRIAN PROFFIT IS A CONTRIBUTING EDITOR FOR *OS/2 MAGAZINE* AND *OS/2 DEVELOPER* AND IS THE AUTHOR OF *OS/2 APPLICATION DEVELOPMENT TOOLS* (PREMIER PUBLISHING) AND *OS/2 INSIDE & OUT* (OSBORNE MCGRAW-HILL).



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Toolkits

BY TOM RAWSON

Track Bugs with PVCS Tracker

To make the product you ship as bug-free as possible, you need a reliable way to track bugs during development. Intersolv's PVCS Tracker for Windows, Version 2.10 is a flexible and comprehensive package for doing just that. Whether you're an individual developer or managing a team of programmers, Tracker is an invaluable tool for keeping things organized. Pricing starts at $499 per user and drops as the number of users increases. (Tracker was previously published by The Software Edge under the name Defect Control System for Windows. Intersolv purchased the company and changed the product name just as we were going to press.)

Tracker is centered around a database for tracking program bugs and their resolution. Individual developers will find the program useful for organizing and retrieving information about bugs and fixes. Programmers working as a team can use the program on a network and exploit the new mail capabilities in Version 2.10. Reporting features let you track defect submission and resolution rates over time and summarize the distribution of defects by programmer, code module, and other criteria. Data can be imported from delimited ASCII files and exported for further analysis, using spreadsheets or other tools.

Each Tracker defect record includes a few standard fields like Title and Submit Date. You can add up to 12 custom string fields and 18 multiple-choice fields. Numeric and date fields are not supported. Defect records can be augmented by attaching related files and notes.

Much of your work in Tracker takes place through the In Tray, which appears when you log in. The top pane typically shows items you're working on and lets you select them for display or editing. On a network the top pane can also include new defects assigned to you and messages from other Tracker users. The bottom pane shows details on the selected item. You have complete control over which items are placed in your In Tray, and stylesheets let you change which details are shown and how they appear.

The powerful Query tool lets you select and sort defect records for display or printing. The selection and sort options include full Boolean expression support; dialog boxes simplify the entry of even complex specifications. You can select items for editing from the on-screen query results.

Tracker's network support includes security features such as user groups and field-level access permissions, along with a dazzling array of notification options. For example, you can have each defect you submit placed back in your In Tray so you can track the defect's progress, or you can request a message when anyone changes a specific field in a defect you're working on. If you have PVCS Notify, you can automatically notify users on the LAN when a Tracker database is updated, via cc:Mail or Microsoft Mail. (Notify, which costs $995, was called DCS Mail Server before the purchase by Intersolv.)

Version 2.10 adds an interface to PVCS, Intersolv's popular version-control package, so you can check modules in and out of PVCS archives from within Tracker. (PVCS itself is a separate purchase.) An advantage of this integration is the ability to link PVCS log files with defect records. In your Queries and In Tray, you can see the source changes associated with repair of a particular defect, and you can embed defect record information in your PVCS log files.

Tracker's screens and dialogs are generally consistent and easy to use, and on-line help is available when you need it. Though the index is somewhat meager, the documentation is comprehensive and well written. Tracker isn't cheap, but if you need a complete and flexible package for bug tracking, Tracker is an excellent choice.

▶ **PVCS Tracker for Windows, Version 2.10.** List price: *Single-user version, $499; volume discounts available.* Requires: *4MB RAM, 6MB hard disk space, Microsoft Windows 3.1 or later.* Intersolv, *1700 NW 167th Pl., Beaverton, OR 97006; 503-645-1150; fax, 800-547-7827, 503-645-4576.*

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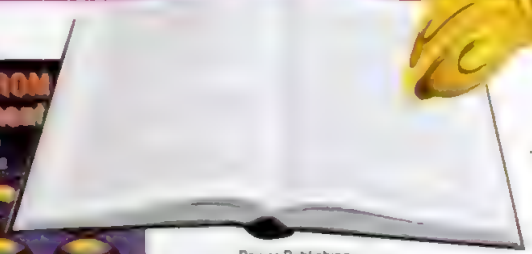
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Environments

BY CHARLES PETZOLD

Why Windows 95? A Historical Overview

In the fall of 1986, readers of this magazine got their first glimpse of an exciting new class of personal computers: those built around the Intel 386 microprocessor. At the time, the promise of the ease and efficiency of pure 32-bit programming seemed just a short wait away.

Alas, nothing is ever quite that simple. Eight years after the release of those early 386 machines, and at a time when 486s are considered the minimum standard for a new machine, the vast majority of users are still running what is fundamentally a 16-bit graphical environment—Windows 3.1—on top of DOS. Those who think the personal computing industry moves too quickly can get a reality check by pondering that eight-year delay.

Of course, 32-bit operating systems that run on the Intel's series of 32-bit microprocessors do exist. Unix and its variants were adapted fairly quickly for the 386. More recently, we've seen the releases of OS/2 2.*x* and Windows NT, both of which exploit 32-bit technology. But none of these environments have achieved anything close to the popularity of the 16-bit DOS/Windows combination.

It's not as if users and programmers don't want to move to a 32-bit environment. They certainly do, whether they know it or not. But various factors—inertia, politics, marketing—have conspired to prevent change in that direction. I'll have more to say about these factors later in this column, because understanding the past is important for dealing with the future.

Dealing with the future means dealing with Windows 95. Windows 95 (previously code-named Chicago and expected by many to be called Windows 4.0 before Microsoft's announcement to the contrary) seems the best bet now for bringing 32-bit software to the masses. At the time of this writing, it's uncertain just when Windows 95 will be released; presumably the release date will be closer to the beginning of 1995 than the end. (If it's delayed until fall, for example, Microsoft might best follow the example of automobile manufacturers and call it Windows 96.) Regardless, once we convince ourselves that Windows 95 is the way to go, it's never too early to begin learning how to code for it.

Dealing with the future means dealing with Windows 95. It now seems to be the best bet for bringing 32-bit software to the masses.

OF MOUSETRAPS AND OPERATING SYSTEMS When I was growing up, one of my mother's inspirational sayings was "Build a better mousetrap and the world will beat a path to your door." Being technically inclined even at an early age, this concept appealed to me. Recently, I discovered that this saying is actually attributed to Ralph Waldo Emerson (in a far more awkward and less pithy form): "If a man can write a better book, preach a better sermon, or make a better mousetrap than his neighbor, though he builds his house in the woods the world will make a beaten path to his door."

If there's anything we can learn from the past decade of personal computing, it's that Emerson (and my mother) were wrong. Those of us who count ourselves among the techies of this industry are often more naive than we care to admit. When we see a shining example of technical excellence, we believe that the rest of the world must see what we see, and that they will make a beaten path to their nearest computer store to buy the latest and greatest.

In other technically oriented industries, sometimes this works and sometimes it doesn't. Compact disks did replace vinyl LPs, for example, despite the new hardware required. Then again, Beta-format video tapes lost out to VHS, which many people considered inferior. In the personal computing industry, we have seen several examples of superior operating systems being ignored by both users and developers. Let's try to figure out why.

WHAT WENT WRONG? This industry generally looks to two companies for guidance: Microsoft and—although less influential in recent years—IBM. Needless to say, both have stumbled quite a bit. Let's begin with the OS/2 debacle. As long-term readers of this column know, I was an early proponent of OS/2. Indeed, the Environments column began as an OS/2 column. (The only reason it was called Environments was because the magazine's art department needed a name before we knew that OS/2 was to be called OS/2. Otherwise, the column would have been called something like The OS/2 Developer.)

I first worked with a beta version of OS/2 1.0 in the fall of 1986—ironically, about the same time that the first 386 machines were being released. OS/2 1.0 was a nongraphical environment designed to use the protected-mode features of the 286 chip. It seems that nobody really anticipated how quickly the 386 would dominate the industry, but we see here a seri-

ous gap between hardware and operating-system software.

OS/2 1.0 wasn't announced until April 1987 (at which time IBM also announced their first 386 machines in the PS/2 line), and it wasn't released until December. DOS compatibility was imperfect, and the Windows-like graphical environment didn't arrive until OS/2 1.1 in October 1988. When the history of this industry is written, OS/2 could be the primary example of a technically superior product that falls victim to Murphy's Law. Nothing went right. Although the initial releases were prompt, they seemed late because they didn't support the 386 and were incomplete (no graphical environment in 1.0 and not very many printer drivers in 1.1).

Perhaps the biggest mistake was the extensive change in the application programming interface (API) from Windows to the OS/2 Presentation Manager. Fundamentally, the APIs were structured very similarly, but they differed in almost every detail. This idiocy must be blamed on both IBM and Microsoft—IBM for wanting a different API and Microsoft for agreeing to the change. At a time when Windows was beginning to attract more programmers, the different Presentation Manager API seemed daunting and absurd. Software houses were stuck deciding whether to code for Windows or OS/2, or to dilute their talent by targeting both environments. The result: Few applications were written for the OS/2 Presentation Manager, and most users found no reason to switch over.

Meanwhile, though Microsoft saw the need for a 32-bit version of OS/2 and proceeded to work on it, IBM insisted on fine-tuning the 16-bit version. But also, within Microsoft some clever programmers discovered how to make Windows run in protected mode, offering more memory and better interprocess protection.

The result (Windows 3.0) was released in May 1990, and quickly became a common sight on users' machines. Windows was a product whose time had come. IBM-compatible users were ready to move to a graphical environment, and Windows 3.0 offered the memory access and protection necessary for such an environment to be palatable.

But the success of Windows created conflicts between IBM and Microsoft. How could Microsoft be loyal to the future of OS/2 when Windows was clearly the marketing champ? By September of 1990, the joint development agreement between IBM and Microsoft broke down. IBM took over OS/2, and Microsoft focused on Windows.

OS/2 2.0—finally, the first 32-bit OS/2—was originally scheduled to be released by the end of 1990. Perhaps it could have been had Windows not struck the gold mine and IBM and Microsoft continued to plug away at it. But left to fend for itself, IBM couldn't get OS/2 2.0 out until the spring of 1992.

IBM did manage to ship OS/2 2.0 in quantities few people anticipated, but the product didn't seem to have much of an effect on the industry. IBM does not have the skill Microsoft does in convincing independent software vendors (ISVs) to write applications for its environment. To this day, 32-bit OS/2 programs are quite scarce.

WINDOWS IN 32 BITS The problems with OS/2 seemed to teach Microsoft an important lesson: It is simply impractical to ask developers to learn a new environment every couple of years. It was tough enough for DOS developers to tackle the intricacies of Windows; telling them to then shift to the OS/2 Presentation Manager was just ridiculous. Still, the problem remained how to get the existing Windows applications and user base to move to a 32-bit environment.

Converting any large application from 16-bit to 32-bit is not trivial, and the problems are compounded by an environment originally written for 16-bit machines, with (apparently) little thought for the future.

Microsoft has provided three different solutions and three different (but strongly related) APIs. Windows NT is the solution I like the best. This is a powerful and robust operating system built from the ground up to use 32-bit processors and to be portable to RISC machines. Windows NT includes many enhancements to the Windows API, some of which I've explored in this column.

If we label the API associated with Windows 3.1 as Win16 (as Microsoft has done), then the API associated with Windows NT can be called Win32. For the most part, Win32 is a superset of Win16. Microsoft has seemingly bent over backwards trying to make the transition from Win16 to Win32 as painless as possible. Some functions have changed and some messages have changed, but a Win32 program looks very much like a Win16 program.

To help developers who need 32-bit processing within their applications but whose programs must run under Windows 3.1, Microsoft introduced Win32s (the *s* is for subset). Win32s is a 32-bit version of Win16, but with virtually none of the enhancements in Win32. Win32s is supported mostly by a dynamic link library that converts 32-bit API calls from an application to 16-bit API calls supported by Windows 3.1.

The third solution is Windows 95. Windows 95 fits somewhere between the Win32s solution and Windows NT. The API is called Win32c (the *c* stands for compatible), and it's almost as extensive as Win32. (Officially, Microsoft has ceased to treat Win32c as a separate API, though it still is.)

WHY WINDOWS 95? In the personal computing industry, people make two essential investments: They choose a computer, most often an IBM-compatible, but possibly a Macintosh or Amiga or a RISC box if that's more appropriate for their needs. They also, in effect, choose an operating system. Sometimes it's built into the machine. For IBM-compatibles, it's often preinstalled. Just check out the ads in this magazine: Machines are routinely shipped with DOS 6.2 and Windows 3.1.

A Windows programmer desiring to move an application to 32 bits can do so with Win32s. These programs will run under Windows 3.1. The only real restriction is that the programs will not run on 286 machines, but that's a small fraction of the Windows 3.1 installed base.

The problem with Win32s is that you're getting only a part of 32-bit performance. Sure, your application can use 32-bit code, but once you call a Windows API function, you're back in 16-bit land. It's clear to me that Win32s is only an interim solution, suited mostly for heavy math-based applications that need 32-bit code.

I'd be very happy if everybody simply

bit the bullet and moved to Windows NT. Those of us who installed Windows NT on top of DOS and Windows 3.1 know that it's almost painless. The CD-ROM install goes quickly and the dual-boot option works well. Windows NT is a rock-solid operating system that has real techie appeal. Of course, Windows NT is also disk-hungry and RAM-hungry. While I've been running Windows NT with 8 megabytes of memory, I can see from the performance that I should have more.

Windows NT is also scary for users. It is, after all, a whole new operating system. It may be much better than Windows, but it's also much different. What if something goes wrong during installation? What if it doesn't run a crucial DOS or Windows application? What if it needs to be deinstalled? Windows NT requires a commitment few users are willing to make. A similar problem with inertia was part of the reason why OS/2 was never accepted. I'm not implying that Windows NT is doomed to failure. I think in the long term it will become a dominant fixture in personal computing. But this will take some time.

So, if we believe that a 32-bit Windows for the masses is inevitable and necessary, we're left with one choice: Windows 95. It wins by default.

IS IT A HACK? We like to visualize our personal computing software in the form of a pyramid. Making up the solid bottom foundation is an unbreakable operating system kernel that handles the low-level basics, such as memory management, the file system, and tasking. On top of the kernel is an environment (such as Windows) that takes care of the user interface and graphics. And on top of the environment, our applications run.

Visualizing this architecture as a pyramid—big at the bottom and small at the top—reflects sophistication and robustness rather than code size. Often, the kernel can be quite small. Yet it must be crash-proof. Applications can, of course, be buggy and ill-mannered. But there must be a way to protect the rest of the system from these rogue programs.

I never liked the idea of Win32s because it turned the pyramid upside down. You have a 32-bit Windows application running on top of a 16-bit protected-mode version of Windows running on top of poor old DOS. It's aesthetically and technically unappealing.

When Microsoft first discussed the idea of a DOS-based 32-bit version of Windows, I had a similar reaction. It sounded like a hack. Sure, it could be done, but again, the architecture seemed completely perverted. Still, Windows 95 turned out to be more sophisticated than the original concept implied. While Windows 95 was originally going to run on top of DOS 7.0, the architecture was revised to replace DOS entirely. Thus, Windows 95 is closer to Windows NT than any previous version of Windows—a more rational approach.

Windows 95 also gives us much of what we've come to expect from a modern operating system. I've already mentioned the 32-bit architecture, but another important enhancement is preemptive multitasking. Long filenames are also very nice. I'm not sure about the user interface yet, but I'll probably get used to it. And Plug and Play—the feature that lets you install a new board in your machine and have the operating system figure out what it is and how to use it—is such an obvious no-brainer that all the major players in the PC industry should be embarassed that it's taken us so long to get it.

Windows 95 is not a hack. It's a true evolutionary advance over Windows 3.1 that approaches the sophistication of Windows NT.

In short, Windows 95 is not a hack. It's a true evolutionary advance over Windows 3.1 that approaches the sophistication of Windows NT.

WHAT TO TARGET Programmers cannot simply search the world for the most exquisitely designed, most technically excellent operating system and code for it. Nobody may be running that operating system, and the code will be wasted. As we've learned, program developers must also develop a marketing and political savvy that will help them identify the dominant operating systems of the future.

I think Windows 95 will be to Windows 3.*x* what Windows 3.*x* was to Windows 2.*x*, and that at some point in the future, Windows 95 will merge with Windows NT.

As usual, corporate PC coordinators are raising the most objections to a new version of Windows. They'll have to oversee conversions of existing systems and maintain user support during the interim period of two different (though related) user environments. I have a similar problem: I'ld like to write a definitive Windows programming book and witness a shelf life of more than a year or two. The best I can say is: Think of it as job security.

Here's a question for you: When you look at ads for new machines now and see that they include Windows 3.1, do you doubt that in six months time those ads will be changed to Windows 95? That's the true test of its success.

It's interesting that there's been a lot of superficial commentary in the media over Microsoft's choice to name the product Windows 95 rather than Windows 4.0. This demonstrates how much image has overtaken substance in the marketing of operating systems. Most of us would prefer that technical merit be the most decisive quality of software. Fortunately, with Windows 95 we're getting not just a name but also substantial technology.

Why should Windows 95 achieve profound market penetration when Windows NT has not? It will be due in part to the friendlier user interface and the reduced system requirements, of course, but the names themselves *are* significant. How many potential users of a Windows 3.1 successor even know what NT stands for? Indeed, the official Microsoft word is that NT doesn't stand for anything! (It originally stood for "new technology," although I never figured out whether that referred to the microkernel architecture or the RISC processors that NT would run on.) NT is scary; 95 is not. To borrow a marketing phrase from the Windows 3.0 introduction, the name "Windows 95" is cool—at least for the next year. □

Utilities

BY DOUGLAS BOLING

PLICON: Dare To Be Different

Sometimes you feel like a nut, sometimes you don't." You're allowed. Today's graphical user interfaces (GUIs) are all modeled around a set of common design guides. While commonality has its place, it's okay to get nutty now and then. Think about it. Just why do minimized program icons have to sit at the bottom of the Windows desktop? Why not on the side or maybe the top of the screen? Now they can with PLICON.

PLICON, which stands for Place Icons, is a Control Panel applet that lets you tell Windows just where you want those icons to be parked. With PLICON, you can have the icons aligned along the left, right, top, or bottom of the screen. Since it is a Control Panel applet, PLICON does its work transparently. There's no need for you to start a program, no extra icon sitting on the desktop—no hassles.

If being different is your cup of tea, you can download PLICON from *PC Magazine*'s PC MagNet. You will find it in the Utilities/Tips Forum. For details, refer to the sidebar "Guide to Our Utilities & How to Get Them." If you want to differentiate yourself further, the C source and other necessary files are provided so you can make your own modifications. PLICON was written with Microsoft C 6.0 and should work with any Microsoft C or compatible compiler. Make files are provided for the Microsoft C 6.0 and Borland C++ 3.1 compilers.

USING PLICON Because PLICON is a Control Panel applet, the installation process is slightly more involved than that of a standard Windows program. PLICON does most of the installation work. All you have to do is to copy the two necessary files, PLICON.EXE and PLIDLL.DLL, into a directory on your hard disk and then start PLICON using the File | Run menu selection in Program Manager. There is no need to create an icon for PLICON, since, once installed, there is no reason to start the program again!

When the PLICON window appears, you will see a simple dialog with three buttons: Install, About, and Exit. Clicking on the About button displays the About box with the copyright information. The Exit button will terminate PLICON without taking any further action.

The real fun comes with clicking on the Install button. Doing this causes PLICON to make the necessary changes to your Windows setup to install PLICON. (Don't worry: PLICON is just as easy to uninstall as it is to install.) After PLICON installs, its window disappears; but before this happens, PLICON starts the Control Panel and presents its Control Panel applet.

Top 10 Utilities

Rank	Utility	
1	**FINDIR**	*Locates available IRQs*
2	**WINCMD**	*Command file interpreter*
3	**MYGRPS**	*Customizes group icons*
4	**ALLPAP**	*Sizes wallpaper images*
5	**WTIME**	*Keeps PC clock accurate*
6	**WPNTR**	*Highlights Windows presentations*
7	**QUIKCO**	*Copies disks quickly*
8	**INCTRL**	*Controls Windows installation*
9	**MONTOR**	*Monitors system resources*
10	**WCLIB**	*Function library for WINCMD*

This list is based on the total number of downloads each utility has had on PC MagNet over the past month. To download these files, type GO ZNT:TIPS. For more information, see the sidebar "Guide to Our Utilities & How to Get Them."

The PLICON Control Panel applet window is simple but effective. The left side of the window contains four radio buttons that let you select which side of the window to place your icons in. Along the right side of the window are a set of buttons: Close, About, Enable, and Uninstall. As with the PLICON installation window, the About button displays the copyright information.

Clicking the Enable button prompts PLICON to leap into action, moving the currently iconized windows to the appropriate side of the screen. Once enabled, newly minimized windows will be placed next to the other icons on the proper side of the screen. Also when PLICON is enabled, the text of the Enable button changes to Disable. Clicking on the Disable button disables PLICON and causes the icons to return to their traditional positions along the bottom of the screen.

Once PLICON has been installed and enabled, you can close the applet by clicking on the Close button. Since the Control Panel applet was opened by the PLICON install routine, you will notice that the Control Panel window closes along with the PLICON applet. To reopen the PLICON applet, start the Control Panel by clicking on its icon in Program Manager. You should see the PLICON icon inside the Control Panel along with the icons for the Desktop applet, the Colors applet, and the others. Clicking on this icon will bring up the PLICON Control applet again.

If you are happy with the way PLICON works, you don't need to take any further action. The next time you start Windows, PLICON will be there, positioning those icons right where you want them. If, on the other hand, you decide you do not want PLICON on your system, it can be quickly uninstalled. Just bring up the PLICON Control Panel applet and click on the Uninstall button. After you click on Yes in the confirmation dialog box, PLICON will undo the changes made to the Windows setup that let PLICON operate. The next time you start the Control Panel, the PLICON icon will no longer be shown in the Control Panel window. To completely wipe the last vestiges of PLICON from your system, you will

need to delete the files PLICON.EXE and PLIDLL.DLL yourself.

INSIDE PLICON The Control Panel interface is perfect for a program like PLICON that modifies how the Windows interface is presented to the user. Writing a Control Panel applet is different from writing a standard Windows application, but it isn't difficult.

The Windows 3.1 Control Panel is an extendable application that not only loads the default applets for controlling items such as the system colors, printers, and virtual memory, but can also load customized applets supplied by third parties. The applets themselves are just DLLs with a standard interface that the Control Panel calls to control and launch the applet. Custom applet DLLs can contain many Control Panel applets. Each applet is represented by an icon in the Control Panel window.

Message	Description
CPL_INIT	First message sent. It is sent immediately after the DLL is loaded. This message gives the applet an opportunity to perform any initialization tasks necessary.
CPL_GETCOUNT	Sent to determine how many applets a DLL contains.
CPL_INQUIRE	Obsolete message used by the Multimedia version of Windows 3.0. This message has been replaced by the CPL_NEWINQUIRE message in Windows 3.1.
CPL_NEWINQUIRE	Sent to query necessary information about the applets in the DLL. One message is sent for each applet in a DLL.
CPL_SELECT	Sent when the user selects an applet's icon.
CPL_DBLCLK	Sent when the user double-clicks the applet's icon. The applet will generally respond by displaying its configuration dialog box.
CPL_STOP	Sent once for each applet just before the control panel ends. This allows the applets to perform any cleanup needed by individual applets.
CPL_EXIT	Last message sent by the Control Panel—sent once to each DLL just before the Control Panel ends. This is a good place to perform any Control Panel cleanup.

***Figure 1:* Shown here are the messages that the Control Panel sends to applets that appear in its window.**

When the Control Panel starts, it first loads the Windows default applets. Next, it looks in the [MMCPL] section of its .INI file, CONTROL.INI, for any listed DLLs. Finally, it checks for any DLLs in the Windows and Windows system directories that have .CPL extensions. For each of these DLLs, the Control Panel checks for an exported entry point labeled "CPlApplet." If this is found, the DLL is assumed to be a valid Control Panel applet.

The Control Panel communicates to the applets through a series of messages sent to the CPlApplet procedure in the DLL. The applet responds to the messages in the CPlApplet procedure and returns. Since the applet is in a DLL, it really is not an application at all, only an extension of the Control Panel application.

The messages sent by the Control Panel to its applets are not the same as those sent by Windows to a program's main window. In both cases, the messages are procedure calls with a parameter identifying the reason for the call (the "message") and a set of generic parameters with different meanings depending on the message being sent. But the CPlApplet procedure has a different set of generic parameters than those of a window procedure; there are two long word parameters—lParam1 and lParam2—instead of the wParam and lParam parameters used by window messages.

The messages sent by the Control Panel to the applet are shown in Figure 1. The interface is fairly straightforward. When the DLL is first loaded by the Control Panel, a CPL_INIT message is sent. This message gives the opportunity for the DLL to perform any initialization necessary.

Although the CPL_INIT message duplicates the function of the LibMain procedure for the library, it serves an important purpose. If the DLL is used for more than just a Control Panel applet, the DLL already may have been loaded and the LibMain procedure called. The CPL_INIT message gives a dual-use DLL the opportunity to perform any Control Panel–specific initialization. If an error occurs when processing the CPL_INIT message, the DLL can return a zero to the Control Panel indicating that the DLL cannot be loaded. In this case, the Control Panel will perform no further action on that DLL. A nonzero return value indicates that the message was processed correctly.

Once the DLL has been loaded, the Control Panel sends a CPL_GETCOUNT message to determine how many applets are contained in the DLL. The DLL should respond to this message by returning the number of applets.

The Windows 3.1 Control Panel then sends one CPL_NEWINQUIRE message to the DLL for each Control Panel applet. The value in the lParam1 parameter indicates the applet to which the message is referring—0 for the first applet and one less than the value returned in CPL_GETCOUNT for the last applet. The lParam2 value in the message points to a NEWCPLINFO structure. A description of the structure, taken from the Windows Software Development Kit help file, is shown in Figure 2.

The dwSize parameter is a sanity check for Windows and must be filled in with the size in bytes of the NEWCPLINFO structure. Unfortunately, the dwFlags parameter is not documented in either the SDK help file or the CPL.H include file. The dwHelpContext value is passed to the help file (if specified) when the applet's icon is selected and the user requests help from the Control Panel. This value allows one help file to contain the help text for multiple applets. The name of the help file is specified in the szHelpFile field. If no help file is used, this field should contain a null string and the dwHelpContext field will be ignored.

The lData value is an application-defined value that is passed to the applet in the CPL_SELECT and CPL_DBLCLK messages. The hIcon field is filled with the handle of the icon that will be used to represent the applet in the Control Panel window.

The szName field should be filled with a short name of the applet. This string is used as the title for the applet's icon. The szInfo field should contain a short description of the applet's function. This string is displayed in the Control Panel's status line when the applet's icon is selected.

Since the CPL_NEWINQUIRE message is sent for each applet in the DLL, the values returned will be specific for each applet. At a minimum, each applet will need a different icon, title, and status-line text.

A CPL_SELECT message is sent to the DLL when the user selects an icon representing an applet in the DLL. The

lParam1 parameter contains the zero-based number indicating which applet has been selected. The lParam2 parameter contains the lData value that was returned in the NEWCPLINFO structure. Generally, there is not much an applet should do in response to this message. I suppose Microsoft included it for completeness. In fact, in some versions of Windows (for example, Windows for Workgroups), the CPL_SELECT message and the CPL_STOP message discussed below are not even sent.

Processing the CPL_DBLCLK message is where the action is. The Control Panel sends a CPL_DBLCLK message to the DLL when the user double-clicks on an applet's icon or selects the applet's menu item in the Control Panel menu. As with the CPL_SELECT message, the lParam1 parameter indicates which applet has been selected, while the lParam2 parameter contains the lData value from the NEWCPLINFO structure. In response to this message, an applet should display a window that lets the user configure the applet. Generally, this means a dialog box with controls that can change the parameters used by the applet. The user then makes any changes and closes the dialog, and the applet returns to the Control Panel.

When the user closes the Control Panel, it sends one CPL_STOP message for each applet in the DLL. The lParam1 value indicates the target applet. This message is a signal to the applets to perform any necessary cleanup.

Once all the CPL_STOP messages have been sent, one CPL_EXIT message is sent to the DLL just before the DLL is freed by the Control Panel. This message gives the DLL an opportunity to perform any general DLL cleanup necessary. While this message in some ways duplicates the DLL's WEP procedure, it works like the CPL_INIT message to allow cleanup specific to the Control Panel operation. For example, if other applications have also loaded the DLL, the WEP procedure would not be called until all applications had freed the DLL. The CPL_EXIT message is sent when the Control Panel frees the DLL.

The mechanics of a Control Panel applet look simple, and they are! Simply write a DLL with an exported CPlApplet procedure that processes the proper messages. To make sure the Control Panel finds the DLL, give it a .CPL extension and put it in the Windows directory. The next time you start up the Control Panel, you will see your applet's icon. That is the easy way. As you shall see below, PLICON uses a slightly different technique so that the PLICON files do not clutter up your Windows directory.

```
typedef struct tagNEWCPLINFO /* ncpli */
{
    DWORD dwSize;          /* length of structure, in bytes     */
    DWORD dwFlags;         /* setup flags                       */
    DWORD dwHelpContext;   /* help-context number               */
    LONG  lData;           /* application-defined data          */
    HICON hIcon;           /* handle of icon (owned by CPL.EXE) */
    char  szName[32];      /* short-name string                 */
    char  szInfo[64];      /* description string (status line)  */
    char  szHelpFile[128]; /* path to help file                 */

} NEWCPLINFO;
```

***Figure 2:* The Control Panel message parameter lParam2 points to a NEWCPLINFO structure. The layout of this structure is shown here.**

MOVING ICONS Now that I have described the Control Panel applet portion of PLICON, it is time to look at how the icons are pushed around the desktop. PLICON accomplishes its task in three parts. When it is first started or a new side for the icons is selected, it moves the icons already on the desktop to the appropriate spots and modifies the icon positions of all noniconized windows to a position of -2, -2. When a top-level window (a window without a parent window) is created, the window's icon position is also modified to -2, -2. Finally, when a window is minimized and has an icon position of -2, -2, PLICON computes the new icon position on the appropriate side of the screen and substitutes this icon position just before the window is minimized. Simple stuff on the surface, but somewhat more complicated in implementation.

The mechanics of a Control Panel applet are simple: Write a DLL with an exported CPlApplet procedure and give it a .CPL extension.

To accomplish these three tasks, you must be able to do three things: Modify the icon position of a window, know when a top-level window is created, and know when a window is about to be minimized. The Windows icon position is modified using the SetWindowPlacement function. This function lets an application modify the position of a window, its icon position, and its z-order (which indicates how the windows are stacked on the screen), all in one call. More importantly, the icon position can be modified even if the window is not minimized. A companion function, GetWindowPlacement, lets an application query these same values.

Knowing when a top-level window is created is a bit more involved. PLICON uses a system hook of type WH_SHELL to obtain the information. The hook procedure receives a message every time a top-level window is created or destroyed, as well as when the desktop shell should be activated. Systemwide hooks under Windows require some preparation. First, the hook procedure must be contained in a DLL. Also, the hook procedure itself should be short, so that calling it repeatedly does not affect system performance.

When the shell hook procedure detects that a top-level window has been created, it can not just modify the icon position by calling SetWindowPlacement. Because Windows calls hook routines from deep inside the Windows code, the system is in an unstable state and you cannot call most Windows functions. One of the few calls you can make, however, is PostMessage. So, to modify the minimized positions of newly created windows, the hook function posts a user-defined message to a hidden PLICON window. When the message is received by

the hidden window, a call is made to SetWindowPlacement to set the icon position to -2, -2.

The last piece of the icon-placing puzzle is detecting when a window is being minimized. To detect this, another system hook—this time a system message hook—is used. When this hook is set, a call is made to the hook routine whenever a message is sent to a window. As you might expect, this routine is called a huge number of times by Windows, and so needs to be written with extreme care. PLICON checks for only one message: WM_WINDOWPOSCHANGING. If any other message is sent, the hook routine returns immediately.

Windows sends WM_WINDOWPOSCHANGING messages to a window before it is actually moved or sized to notify it of the pending action. The lParam variable in the message points to a structure that gives the new position of the window. The hook procedure checks to see if the window is to be minimized and if the new position is -2, -2. If so, the hook routine modifies the target coordinates of the icon to place it on the proper side of the window.

BRINGING IT ALL TOGETHER Users may be wondering why there are two files—PLICON.EXE and PLIDLL.DLL—since everything I've talked about so far involves the DLL. Programmers may be wondering how the DLL, which contains the necessary hook code, stays around after the Control Panel closes. The answer is that the .EXE file is used as a placeholder to keep the DLL in memory.

DLLs, by their very nature, cannot exist in memory without a program implicitly or explicitly loading them. The Control Panel explicitly loads PLIDLL.DLL because the DLL's name is listed in the CONTROL.INI file. However, once the Control Panel closes, PLIDLL.DLL, which contains both the Control Panel applet code and the code for the system hooks, would normally be freed and removed from memory. To prevent this, the DLL starts PLICON.EXE whenever the DLL is loaded and a copy of PLICON.EXE is not running.

Since PLICON.EXE also loads the DLL, closing the Control Panel does not free PLIDLL.DLL. The user does not notice PLICON.EXE running because the

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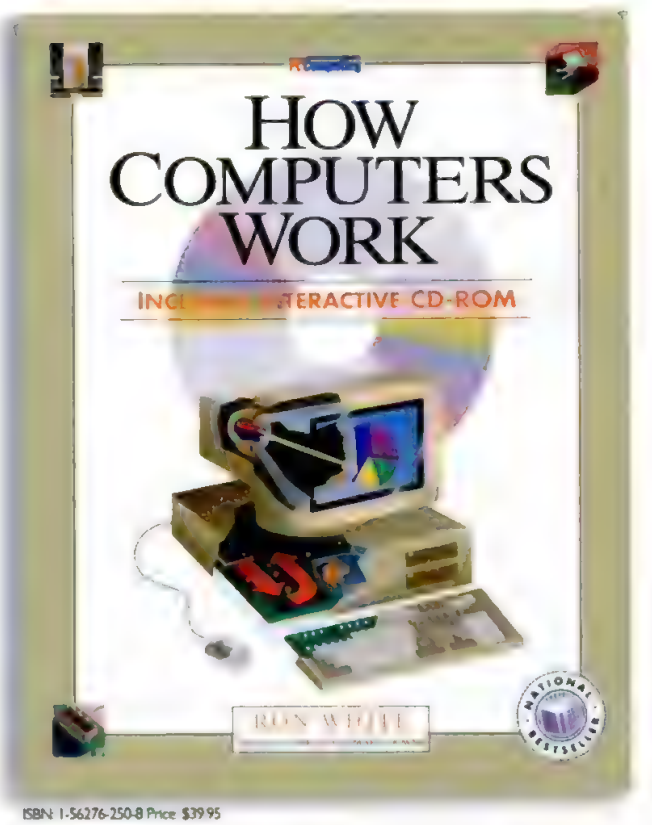

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window created by PLICON is hidden. The only time the PLICON window is seen is when it is started by the user and it detects that the Place Icons Control Panel applet has not been installed.

During the installation process, PLICON makes two modifications to the system setup. First, it adds a line in the [MMCPL] section of CONTROL.INI so that the Control Panel applet will be loaded. Second, the LOAD= line in WIN.INI is modified to include PLICON.EXE. This second modification causes PLICON, and therefore PLIDLL, to be started each time you start Windows. The code in PLIDLL can then go about its business moving those icons around the screen.

In both purpose and design, PLICON is different. The user interface is unusual because PLICON is a Control Panel applet rather than a regular Windows program. The technique of having a DLL load an .EXE file to ensure that the DLL file remains in memory is also unusual. Being different can be fun. Dare to be different—try PLICON. □

DOUGLAS BOLING IS A CONTRIBUTING EDITOR OF *PC MAGAZINE*.

GUIDE TO OUR UTILITIES & HOW TO GET THEM

PLICON

PURPOSE: PLICON gives you control over the position of minimized icons on the desktop. Icons can be placed along the left or right sides of the screen or across the top or bottom.

SETUP: To install PLICON, simply copy the files PLICON.EXE and PLIDLL.DLL to a directory on your hard disk.

Launch PLICON by selecting the File | Run menu item in Program Manager. After the PLICON window is displayed, click on the Install button to install PLICON.

Once installed, PLICON can be controlled through the PLICON applet in the Control Panel. PLICON can be uninstalled by opening the Control Panel applet and clicking on the Uninstall button and then deleting the PLICON.EXE and PLIDLL.DLL files.

REMARKS: The PLICON Control Panel applet window is simple but effective. The left side of the window contains four option buttons that let you select which side of the window to place your icons in. Along the right side of the window are a set of buttons: Close, About, Enable, and Uninstall.

Clicking the Enable button prompts PLICON to leap into action, moving the currently iconized windows to the appropriate side of the screen. Once PLICON is enabled, newly minimized windows will be placed next to the other icons on the proper side of the screen. Also, when PLICON is enabled, the text of the Enable button changes to Disable. Clicking on the Disable button disables PLICON and causes the icons to return to their traditional positions along the bottom of the screen.

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■ HARDWARE

More Power to You

❓ Thanks to the increasingly low cost of laser printers, these printers have been proliferating in our facility. Unfortunately, I'm responsible for power problems in the building, and all those printers have created a nightmare: They cause the fluorescent lights and many incandescent lamps at our workstations to flicker. And sometimes the PC screens momentarily shrink if two or more printers are on the same circuit. I've consulted with power-conditioner and surge-suppression vendors with no success. According to one Hewlett-Packard document, the solution is to have a circuit of sufficient size and capacity to avoid a voltage drop. I've installed a 20-amp circuit to a dedicated outlet, but the problem persists. Do you have any ideas that might help?

Donald P. Zanetti
Billerica, Massachusetts

▶**PC MAGAZINE:** The problem may persist simply because your building's main electrical service cannot handle the load imposed by the crop of new laser printers.

As documented in the HP technical support paper you included, laser printers can draw enormous amounts of power. While a desktop PC typically uses an amp or two of current (about 200 watts), most laser printers draw from 2 to 10 amps (200 to 1,000 watts) while printing. Indeed, some lasers have peak power consumption levels of nearly 30 amps (more than 3,000 watts). To put this in perspective, a bright incandescent bulb draws only about 100 watts; a hair drier or toaster typically uses about 600 watts. So to approximate the peak load imposed by a large laser printer, you'd have to turn on half a dozen hair driers at the same time.

One solution would be to put all the computers on standby power supplies that offer voltage regulation. That should eliminate the change in monitor-image size that comes from the voltage drop. This can be an expensive proposition, though, even if you create dedicated circuits and use one or two large units to serve all the computers. And it still wouldn't prevent the lights dimming.

Normally, running a dedicated circuit directly from the main service box would solve your problems. The fact that it did not suggests that the problem is indeed fundamental. Even a dedicated circuit will work only if there is sufficient power being delivered via the main electrical service. Typical home electrical services are often rated for only 100 amps—200 amps if there are lots of electrical appliances. Hook up half a dozen computers (2 amps each) with their own printers (10 amps each while printing), add normal lighting and perhaps electrical baseboard heating, and you can easily exceed the capacity of a 100-amp service. The only solution in that case is to increase the service capacity.

What you should do at this point is to conduct a complete electrical-energy audit of your facility. Determine which devices are connected to which circuits and the load and capacity of each of those circuits. The load requirements of most devices are listed on a nameplate, usually near the power connector. Check the totals against the capacity of the total electrical service being delivered to the building. Only then will you know for sure whether your system is adequate for powering all your devices.

This advice is just as applicable to the small office with only one or two computers and a printer as it is to a large office with dozens of machines. Especially in older buildings, you may discover that you need to have some significant electrical work done. But it's better to find that out *before* you have problems than to wait until you suffer a failure.—*Alfred Poor*

A Transparent Solution

TIP In the Solutions column of your February 22, 1994, issue, you addressed a problem that occurs when photocopied forms are fed through a laser printer. You recommended that users "photocopy the original and then photocopy your answers onto the copy."

Rather than run the photocopier twice (once to copy the form, then again to copy the filled-in information), why not save steps by making a transparent overlay? Using a copier-compatible transparency film, make a copy of the form. Then, after printing the required information onto a

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PC DIRECT

PC DIRECT starts here with exciting offers from top direct vendors.

See index, page 274.

Only MidWest Micro Could Alter Scrooge's Fate...

The Ghost of Computers Present—and Future

While Scrooge waited patiently for instructions from the ghost, he grew more and more curious about the strange clutter in their midst. What could be the meaning of these mouth-watering foods mixed with mysterious computer products – the likes of which the old man had never seen?! Finally his answer came...

"I was sent to deliver the Present and *Future* of computer technology," the ghost bellowed. "These Intel-based Elite Systems which surround us have captured the extraordinary powers of PCI and Pentium™. It is now up to *you*, Ebenezer, to release them."

The spirit's thundering voice sent chills up Scrooge's brittle spine.

"Please, wise spirit, have mercy upon me. Tell me more about these 'Elites,' and what I, a mere mortal, must do to help your cause."

"Many of these fine Elite Systems contain a powerful Intel® Pentium Processor," explained the ghost, "capable of 60, 66, 75, 90 or 100 MHz speeds."

Scrooge never dreamed *anything* could move so quickly.

"While others," he continued, "rely on formidable 486 processors and advanced PCI Local Bus architecture for their impressive performance.

The spirit now turned to the system closest to him, a P5-90 Home PC – and with a single touch, brought its 15" monitor to life.

"Fear not, Scrooge," said the ghost. "Touch the key of your choice, and we shall begin."

Scrooge's trembling index finger came to rest on the symbol that was the dollar sign – in an instant the screen erupted into a multimedia frenzy. Without leaving the room, he saw himself walking about the streets of London – peering into the lives of those less fortunate. He could almost feel the cold air biting his bare feet...smell the aroma of a Christmas goose cooking. He even heard a choir of small children singing.

"Where do these angelic voices come from, spirit?" he asked.

"Altec Lansing Stereo Speakers," said the ghost.

The spirit then explained that it was the combination of a Pentium Processor, superscalar architecture and advanced PCI Local Bus technology that allowed this Elite to access peripherals with such haste.

When the adventure was over the ghost turned off the system and looked down earnestly upon Scrooge.

"These people you have just witnessed, hunger desperately for power. Without an Intel-based Elite System in their lives, I shudder to think what may become of them. You must tell them of Pentium and PCI – of MidWest Micro's affordable PCI, Home PC and Pentium Processor Based Systems!"

"You have my word," promised Scrooge.

"And you, Scrooge, do you hunger as well?"

"Yes, spirit. I too could benefit from the power of an Elite."

"No," said the ghost, "I *mean* are you *hungry*? I fear I cannot eat all this food without help."

And since Scrooge did not expect another spirit until the bells tolled one, he seated himself with the ghost among the awe-inspiring Elites – and thus began to feast.

90 MHz Pentium™ Loud and Strong Enough to Break the Chains

Trembling at the sight of Jacob Marley's ghost, Ebenezer Scrooge still managed to utter one more "Bah Humbug!" Perhaps it was just a bad chestnut or bite of plum pudding causing him to hallucinate. As he was pondering this, the vision spoke...

"Poor old Ebenezer," his dead partner moaned. "This is neither a dream nor indigestion. I have come to warn you before it's too late – you see, these chains I bear are those I forged in life. And unless you change your way of computing, this will be your fate as well. Like you, I believed a faster, more versatile machine was the key to prosperity. Unfortunately, this obsession with power kept me chained to my office – day in and day out. In my search for the perfect computer, I encountered only a few desktop systems swift enough to suit me – but alas, they were dreadfully heavy. And the portables? Why, I fear my horse-drawn carriage could run faster."

Scrooge nodded in agreement, for he recognized Marley's plight.

"Tell me, Jacob, whatever can I do?" he asked.

"Hold onto your nightcap, Ebenezer – for you will scarcely believe what you are about to witness."

Scrooge looked closely at the object floating above Marley's wrinkled hands.

"Why, it's just another notebook," he said.

"No," shrieked Marley, "this is the Elite SoundBook Plus based on Intel's Pentium™ Processor. It's like no other notebook you've ever seen...or heard!"

"And it dares to challenge my full-size computer?" asked Scrooge in amazement.

"Did my words escape you, old man?! The Elite SoundBook Plus has captured the power of *Pentium*! Couple that with its remarkable PCI Local Bus architecture, high-speed synchronous cache and 16-bit stereo sound – and this 90 MHz notebook more than '*challenges*' your cumbersome computer... it clearly outperforms it!"

"But a portable Pentium?!" gasped Scrooge. "A talking 90 MHz notebook?! It's pure humbug I tell you."

Yet Ebenezer prayed this spirit spoke the truth. For an invention such as this would surely double his productivity – and thus free him from his dark and gloomy office. Marley then summoned the Elite 486 SoundBook with business audio features and an assortment of delightful screens, rapid processors and generous hard drives to choose from.

"Oh thank you, Jacob," cried Scrooge. "Thank you for delivering these remarkable notebooks from heaven's gates to my humble chambers."

"Heaven, indeed!" laughed the ghost. "Elite SoundBooks are found right here on earth – but only at MidWest Micro."

"Then what about the price?" asked Scrooge. "Notebooks such as these surely cost a full year's wages!"

"Wrong again," said Marley. "MidWest Micro knows you don't want to *pay* extra pounds any more than you wish to *carry* them. That's why they offer these lightweight Elites at prices even *your* employees can afford."

And without another word, the late Jacob Marley was gone...leaving only a puff of smoke and MidWest Micro's toll-free number behind.

intel inside
pentium

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AD#G01

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intel inside

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- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 3 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
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#0008661

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- 3.5" Disk Drive
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- Microsoft Mouse
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- 8-Bay Middle-Tower Case
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- Super I/O using 16550 UART & ECP/EPP
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#0008666

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- 10-Bay Full-Tower Case
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#0008693

- Intel 100 MHz Pentium Processor
- 16 Mb RAM, 256 Kb Cache
- 1 Gb IDE Hard Drive
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- 3.5" Disk Drive
- 17" .26 Digital Color Monitor
- 10-Bay Full-Tower Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
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AD#G01

CIRCLE 398 ON READER SERVICE CARD

blank sheet of paper, place the transparent form over the printed information, and run the combination through on the copier. This saves wear and tear on the copier by making the image with only one pass per page.

James Griggs
East Gadsden, Alabama

▶**PC MAGAZINE:** I use this handy technique myself, though unless you're filling out a form you'll be using again, it saves paper more than it does passes through the copier. The suggested procedure still takes two passes: one for the transparency and one for the combined image.

Mr. Griggs's technique does yield some important advantages, however. For one thing, it takes a great deal of effort to create a blank word-processing document in which the answers line up correctly with a preprinted form. Incredibly, many forms still in use do not conform to the 6-line-per-inch spacing and 12-point typeface of a Pica typewriter. By using the transparency method described here you can hold a trial printed page up to the transparency and check that the answers fit within the blanks before making a final copy. This is particularly important in desktop publishing, where you may have projects that use preprinted paper that is either expensive or is in limited supply (or both). Rather than waste such valuable sheets on trial prints, you simply create a transparency of the form and lay it over the type to check alignment and general appearance. You can even make a copy of this to show the client for preliminary approval or for proofing.

When using this technique, there are two important points to bear in mind. First and foremost, be sure to use transparencies that are approved for your copier. The fusing rollers in different copiers use different temperatures and pressures, and you don't want to jam up the paper path with melted plastic. The other point to note is the fact that the optics of some copiers are better than others. With some printers, the image on the transparency may be distorted slightly—not so much that it offends the naked eye, but enough so that the fields will not line up perfectly with the blanks on the form. As a result, you should always make a trial run with the technique before you depend on it when facing a deadline.—*Alfred Poor*

Our Advisors

Douglas Boling is a contributing editor and the author of many utilities, including MBOOT.COM and EMS40.SYS.
Frank J. Derfler, Jr., is senior networking editor and the author of the *PC Magazine Guide to Connectivity*
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OPERATING ENVIRONMENTS

Make Batch Files Execute Just Once a Day

❓I do a lot of regular checking and backups on the three computers in my office and the one at home to ensure that I won't have to start from scratch if things go wrong. I've written a batch file called CHECK.BAT, using programs from DOS and The Norton Utilities to do the job. This file is executed at start-up through a CALL command in AUTOEXEC.BAT.

What I don't like about my batch file, however, is that it is executed whenever I reboot the machine, as when I need to switch from Windows 3.1's English version to Chinese. Is there any way to instruct the computer to distinguish a warm boot from a cold one and to bypass that CALL statement if it is the former? Alternately, is there a way to skip unnecessary executions of CHECK.BAT after, say, 9:00 A.M.?

S.Y. Wai
Hong Kong

```
@ECHO OFF
IF NOT '%3'==''' GOTO SecondTime
ECHO @PROMPT %@ $d $t > C:\BAT\TEMPDTT1.BAT
REM Do NOT replace "COMMAND /C" with CALL in next line
COMMAND /C C:\BAT\TEMPDTT1.BAT > C:\BAT\TEMPDTT2.BAT
C:\BAT\TEMPDTT2

:SecondTime
DEL C:\BAT\TEMPDTT?.BAT
SET DayOfWeek=%1
SET Date=%2
SET Time=%3
```

Figure 1: **DATETIME.BAT gets the current day of the week, date, and time into environment variables.**

►PC MAGAZINE: What you're really looking for here is the ability to execute your CHECK.BAT file just once on any given day. Fortunately, that's not too difficult. It's even been featured in this magazine before, though not for quite a while. Here's what you need to do. First, be sure your PATH includes a directory for holding batch files. Mine is C:\BAT, and I'll use that in the examples.

To start, you need a way to get the current date. The batch file DATETIME.BAT (Figure 1) puts the date into an environment variable. As a bonus, it grabs the time and day of week as well. First it builds a temporary batch file whose single line sets the PROMPT to the %0 parameter (the name of the running batch file) plus the date and the current time. Then it executes that batch file under a secondary copy of COMMAND.COM, redirecting the output to another temporary batch file. This second batch file will contain nothing but a copy of the prompt, something like "datetime Mon 06-13-1994 10:12:58.54." When this batch file runs, it reexecutes DATETIME.BAT, passing the day of week, the date, and the time as parameters. All that remains is for DATETIME.BAT to delete the temporary files and store the parameters in environment variables.

The batch file ONCEADAY.BAT (Figure 2) shows how to run certain lines in a batch file just once a day. First it calls DATETIME.BAT to get the date into an environment variable. Then it checks in C:\BAT for the existence of a marker file whose name is the current date with the odd extension $@!. If such a file is present, it means the once-a-day batch file has already been executed on this date. Otherwise, if there is no file with the extension $@!, the batch file creates a zero-byte marker file called $$$$$$$$.$@!. It renames the marker file

```
@ECHO OFF
CALL DATETIME.BAT
IF EXIST C:\BAT\%Date%.$@! GOTO Already
IF EXIST C:\BAT\*.$@! GOTO Exists
REM > C:\BAT\$$$$$$$$.$@!
:Exists
RENAME C:\BAT\*.$@! %Date%.$@!
ECHO Once-a-day activity happens here.
IF NOT '%DayOfWeek%'=='Mon' GOTO End
ECHO Monday-only activity happens here.
GOTO End
:Already
ECHO The Once-a-day activity already happened
:End
```

Figure 2: **ONCEADAY.BAT demonstrates a method for executing batch commands just once on any day.**

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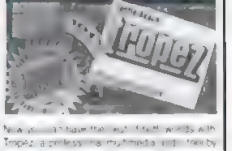

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using the current date as its filename and executes the once-a-day activity. ONCEADAY.BAT also shows that it's also possible to perform once-a-week tasks by using the DayOfWeek environment variable.

The success of this technique depends on having one and only one file with the $@! extension in the C:\BAT directory. In the unlikely event that you have another file with that extension, just pick a different combination of characters.
—Neil J. Rubenking

Retrieving Antique Data

While rummaging around in my "computer attic" I came upon an old CP/M computer and a number of floppy disks containing some of my daughter's writings. I'd like to look at these files on my PC, but I need to convert the disks to DOS. The files themselves shouldn't be a problem; they are WordStar files, so the format is essentially ASCII.

I considered using communications software to transfer the files, but there are over 3MB of files, and at 1,200 bps that would take eons to transfer. I considered printing the material and scanning it in, but again the sheer volume of material is daunting. I tried using The Norton Utilities to read the data a sector at a time, but DOS can't even access the disks.

The hardware is an NEC8201 with external 3.5-inch (yes, 3.5-inch, not 8-inch) floppy disk drives. Do you know of any software that can fool DOS into finding the appropriate sector information so that it can read the disks? Failing that, do you know of any practical way to accomplish this task?

Gerald Harrison
Pleasanton, California

▶PC MAGAZINE: Before the IBM PC came on the scene, most of the wide variety of personal computers used the CP/M operating system. In fact, the first IBM PCs offered CP/M as an alternative to DOS. Each brand of computer had its own variation of CP/M, and most had individual disk formats as well. Computer old-timers will remember the painful process of translating CP/M disks into a format DOS could read and the handy utilities that sprang up to do the job.

Find the Solution!

Full text from the entire last year of Solutions is available for downloading in Windows Help format from ZiffNet. Look for the file Solutions94 (SOL294.ZIP) in the Utilities/Tips Forum (GO TIPS).

Fortunately, at least one of those utilities is still available. Xenocopy, from XenoSoft in Berkeley, California (510-644-9366), will let your PC read dozens of oddball disk formats. You should note, however, that a few disk types simply can't be read by a PC's floppy disk drive: for example, the hard-sectored disks used by early Apple computers. But the NEC8201 is one that can be read successfully, and Xenocopy will do it.
—Neil J. Rubenking

■ WORD PROCESSING

Saving Disk Space with WordPerfect

TIP WordPerfect 6.0 creates significantly larger data files than do earlier versions of the program. You can minimize the file-size inflation, however, by taking advantage of WordPerfect's ability to save in WordPerfect 5.1 or even in 4.2 format. A one-page letter that takes over 6,800 characters in 6.0 format can drop to just over 2,000 characters in 5.1 format and to just over 1,000 characters in 4.2.

You must remember, though, that the 4.2 format does not save graphics. Nevertheless, its small file size makes it ideal for storing letters and other text-only documents.

Gene H. Roos
Metairie, Louisiana

▶PC MAGAZINE: With hard disk prices dropping rapidly, the best answer to larger programs and data files—a larger hard disk—is increasingly affordable. But even if you use one of the popular compression utilities, saving disk space is still a consideration. Archiving correspondence on floppy disk, for example, lets you fit more letters on each disk.

Before you adopt Mr. Roos's suggestion, though, you must be aware of one real danger. When you save a file in an earlier WordPerfect format, you won't lose ordinary text, but you might lose a drawing or table. The lost information may be as minor as the font for the document, but it could also be as significant as a drawing or table it took you hours to create. And note that when WordPerfect converts the file to the earlier format, it won't warn you which features you're losing—or even that you're losing any features at all.

For example, I saved a text-only document in all three formats, and I then loaded the files and they appeared with different fonts in each version. When I added a color graphic to the original 6.0 file, again saved in each format, and then loaded the files again, I wound up with different colors in the 5.1 file—and, of course, no graphic at all in the 4.2 file.

The good news is that the space saved in my tests was significant, though less dramatic than what Mr. Roos found. A single double-spaced page of text took 4,144 bytes in 6.0 format, 3,344 bytes in 5.2 format, and 3,085 bytes in 4.2. The same text with the added graphic took just under 30,000 bytes in 6.0 format and just over 15,000 bytes in 5.1, saving nearly half the number of bytes.

Because of the danger of losing work, you'll want to use this technique carefully, reserving it for documents that are strictly single-column text with little formatting. But when disk space is tight (as in a notebook computer with a small hard disk, for example), it's a convenient shoehorn to keep handy.—*M. David Stone*

■ SPREADSHEETS

Separating First and Last Names

TIP I occasionally need to take a Lotus 1-2-3 label consisting of a person's first and last name and reduce that label to either the first name or the last name. To extract the last name, I use the following formula:

```
@MID(A1, @FIND(" ",A1,0),20)
```

This assumes that the full name is stored in A1 and the last name is not more than 20 characters long. To get just the first name, I wrote the following macro (which

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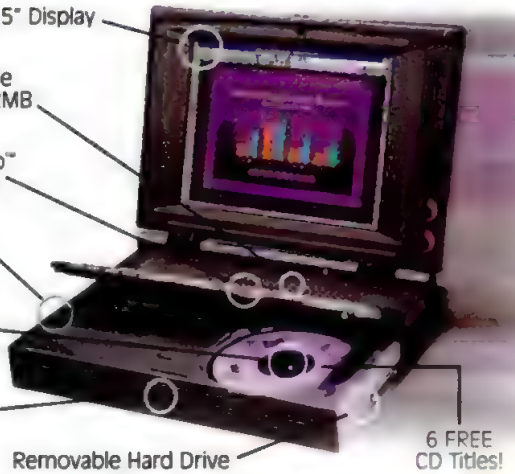

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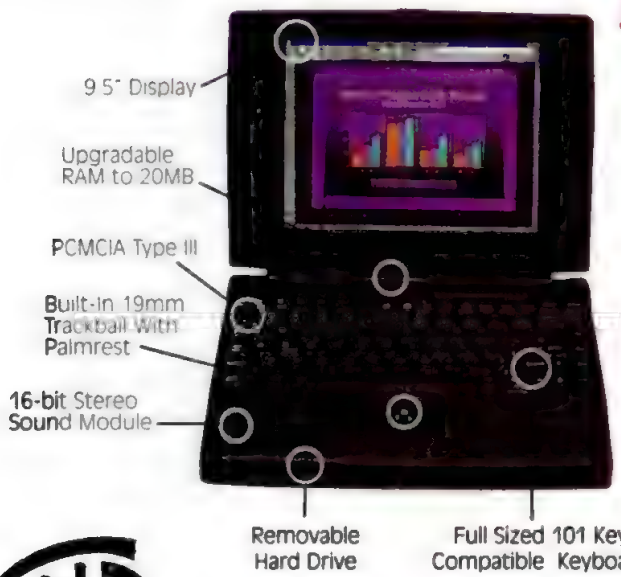

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should be typed all on one line) and named the range \F:

```
{edit}{bs @length(@mid(A1,@find
```

This macro also assumes that the name is stored in A1 and that the last name is 20 characters or fewer. To use the macro, I just put the cell pointer in A1 and press Alt-F. The macro puts 1-2-3 into edit mode and then enters just the right number of backspaces to erase the last name.

When used inside a larger macro, with commands such as {windowsoff}, {if @cell("type",A1)="b"}{end}, and a {branch} to itself, this technique can be used to extract first names from a long list of full names.

The macro, of course, rewrites the original entry with the truncated result. A copy command to another column would alleviate this.

Alex Friedmann
Clifton, Tennessee

▶PC MAGAZINE: Mr. Friedmann's @MID formula returns a space character at the beginning of the last name. To get only the last name, without the trailing space, add a +1, as follows:

```
@MID(A1, @FIND(" ",A1,0)+1,20)
```

If you're replicating this formula down a column in order to pluck the last names from a large number of cells, you might want to add an error trap, like this (on one line, of course):

```
@IF(@ISERR(@FIND(" ",A1,0)),A1,
@MID(A1,@FIND(" ",A1,0)+1,20))
```

This takes care of the possibility that some entry in the column might not include a space character. Without the @IF(@ISERR(...)) construction, a spaceless entry in A1 will cause the formula to return ERR. With this extra baggage, if the referenced cell contains only "Jones," the formula gives you "Jones."

As for the first-name extraction, unless the extraction is part of a larger macro-driven application, it's probably simpler to use the formula

```
@LEFT(A1,@FIND(" ",A1,0))
```

The formula is easier to read than the macro, and if you copy it down a column, the cell references will be updated automatically.

The formula returns everything up to but not including the first space character. Unlike Mr. Friedmann's macro, this formula puts the extracted name into a new cell, leaving the original full-name cell alone. If you want to replace the full name with the first name, start by converting the formula to its calculated result. In the DOS versions of 1-2-3, you do this with the /Range Value command. In 1-2-3 for Windows, copy the formula and then choose Paste Special with the Formulas as Values option. Once you've converted the formula to its result, you can eliminate the full-name cell—or overwrite it by moving the extracted first name onto the full-name cell.

PhDbase is an add-on library that lets you add full-text index and search capabilities to your FoxPro applications or to interactive FoxPro.

Note, by the way, that you don't need an error trap for the first-name-extraction formula. Even if the referenced cell doesn't include a space, @LEFT (A1,@FIND(" ",A1,0)) simply returns the contents of the cell.

All these formulas work in all versions of Quattro Pro, as well as in all versions of 1-2-3, from Release 2.*x* on up.

The Excel equivalent for the first-name formula is

```
=LEFT(A1,(FIND(" ",A1,1)-1))
```

For the last-name formula, it's

```
=MID(A1,(FIND(" ",A1,1)-1)+1,20)
```

or (on one line)

```
=IF(ISERR((FIND(" ",A1,1)-1)),A1,
MID(A1,(FIND(" ",A1,1)-1)+1,20))
```

depending on whether you want the error trap.

In Microsoft Excel, Version 5.0, you can also split a name into its first-name and surname components by means of the Text to Columns command. Leave yourself a blank column to the right of the name column. Select your name (or column of names), pull down the Data menu, and choose Text to Columns. A wizard appears. In the first step of the wizard, make sure the Delimited option is chosen. In the second step, specify "Space" as your delimiter. Click Finish and Excel splits the name (or names) across the original column and the adjacent column. You can also use this technique to break text entries on any other delimiting character—a slash or hyphen, for example. Just type your choice of delimiter in the Other box in the wizard's second-step dialog box.—*Craig Stinson*

DATABASES

Add Text Search to FoxPro Apps

❓ I've read about custom software packages like askSam or Zyindex that specialize in providing full-text search capabilities, but is there anything that will let me build that capability into my Microsoft FoxPro applications?

Ron Brown
Seattle, Washington

▶PC MAGAZINE: Yes. PhDbase III ($295), an add-on library (.FLL, .PLB) from Korenthal Associates, lets you add full-text index and search capabilities to FoxPro applications or to interactive FoxPro. It also adds sophisticated phonetic fuzzy-search ("sounds like") capabilities to FoxPro.

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- (6450609) $249.00

PS/2 70, P 70, 80

- (34F3077 34F3011) $273.00

Compaq

DeskPro 386/20,25

- 4 MB (113132-001) $239.00

DeskPro M, I Series: 286N, 386N, 386SX/20, 20N
SystemPro LT Series, ProSignia PC Server 486/33, DX2/66

- 4 MB (118690-001) $199.00
- 8 MB (128877-001) $395.00

DeskPro 386/33L, 486/25, 486/50L, SystemPro, SystemPro E Series

- 8 MB (116561-001) $409.00

ProLinea 3/25s, 3/25zs

- 2 MB (141738-001) $92.00
- 8 MB (141742-001) $324.00

ProLinea 4/25s, 4/33, 4/50, 4/66 CDS, Presario 4/33S

- 4 MB (141684-001) $199.00
- 8 MB (141685-001) $395.00

Dell

PowerLine Workstations E, SE, DE, TE Series

- 4 MB (310-2467) $225.00
- 8 MB (310-2468) $398.00

Performance L, T, M Series

- 4 MB (310-3315) $179.00
- 16 MB (310-3317) $599.00

Performance ME Series

- 8 MB (310-3335) $395.00
- 16 MB (310-3336) $639.00

Power Desktop 486 P Series, 486 D Series, Progression, Endeavor

- 4 MB (310-2507) $199.00
- 16 MB (310-2625) $639.00

Hewlett Packard

Vectra QS, 16, QS/20, RS/20, RS/25, RS/25C

- 4 MB (D1642A, D1542A) $189.00

Vectra 386/25, 386/25N, 386/16N, 386/20N

- 2 MB (D1354A, D2406A) $92.00
- 8 MB (D2406A) $224.00

Vectra 486 N Series, 486 T Series, 486 PC, 486s/20

- 4 MB (D2156A) $199.00
- 8 MB (D2152A) $395.00

Vectra 486 U Series, 486 ST Series

- 2 MB (D2381A) $120.00
- 8 MB (D2152A) $395.00

NEC

PowerMate 286/12, 286e, SX/16, SX/20, SX/20c

- 2 MB (OP-410-8103) $92.00

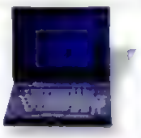
PowerMate Image Series 386/33i, Express Desktop, e Series

- 1 MB (OP-410-6204) $61.00
- 4 MB (OP-410-6285) $199.00

Ready 425, 433, 466

- 4 MB (M/A) $199.00
- 16 MB (M, A) $639.00

Notebook Memory



DELL

Latitude XP 475C, XP 4100CX

- 4 MB (310-3419) $275.00
- 16 MB (310-3420) $942.00

IBM ThinkPad

ThinkPad 300

- 8 MB (33G9289) $480.00

ThinkPad 350, 350c

- 4 MB (79F1000) $250.00
- 8 MB (07G1828) $475.00

ThinkPad 700, 700c, 720, 720c

- 4 MB (07G1420) $265.00
- 8 MB (07G1421) $525.00

ThinkPad 710T

- 4 MB (53G6959) $230.00
- 8 MB (53G6960) $430.00

ThinkPad 750, 750c, 750cs, 750P, 755c, 755cs

- 4 MB (07G1420) $265.00
- 8 MB (07G1421) $505.00

Compaq

Contura 3/20, 3/25, 3/25c

- 4 MB (139498-003) $230.00
- 8 MB (139499-001) $389.00

Contura 4/25 Series

- 4 MB (146529-001) $275.00
- 8 MB (146521-001) $420.00

Portable 486/66, 486c, 66

- 4 MB (118690-001) $199.00
- 8 MB (128877-001) $395.00

LTE Lite 4/25c

- 4 MB (142337-002) $239.00
- 8 MB (142337-003) $440.00

LTE Lite/20, 25, 25c

- 4 MB (129769-002) $299.00
- 8 MB (129769-003) $455.00

LTE Elite 4/40c, 4/50s, 4/40cx, 4/50cx, 4/75cx

- 4 MB (199013-001) $299.00
- 8 MB (199014-001) $590.00

NEC

UltraLite Versa 20, 25, 33, 40, 50 Series

- 4 MB (OP-410-4001) $250.00
- 8 MB (OP-410-4002) $462.00

Toshiba

T2000SX, T1800, T1850c, T2000SXe, T2200SX, T1000LE

- 4 MB (PC-PA2001U) $239.00
- 8 MB (PC-PA2002U) $465.00

T4500, T4600, T1900, T1950

- 4 MB (PC-PA2012U) $289.00
- 8 MB (PC-PA2013U) $515.00

T4400, T6400, T6600

- 4 MB (PC-PA2004U) $260.00
- 8 MB (PC-PA2005U) $465.00

LaserPrinter Upgrades

HP LaserJet II, IID

- 2 MB $128.00
- 4 MB $221.00

HP LaserJet IIP, IIP, IIP IID

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- 4 MB $209.00

HP LaserJet IIIsi, 4, 4M, 4si, 4siMx, XL300, DeskJet 1200c/1200cps

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- 4x36-70ns $639.00
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- 2x8-70ns $78.00
- 4x8-70ns $145.00
- 1x32-70ns $155.00
- 2x32-70ns $305.00
- 4x32-70ns $599.00

Graphics Accelerators

ThunderBolt5A

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ThunderBolt7L

- 1 MB 16 Colors at 1280x1024 $119.00

ThunderBolt7L2

- 2 MB 256 Colors at 1280x1024 $179.00

ThunderBolt7CIT

- 1 MB 16 Colors at 1280x1024 $119.00

ThunderBolt7CIT2

- 2 MB 256 Colors at 1280x1024 $179.00

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1MB	n/a	$109	2MB	n/a	$159

Canon LBP-8II, 8III, 8IT

2MB	363-1080	$119

Epson ActionLaser 1000, 1500

512K	n/a	$95	2MB	n/a	$99

Epson ActionLaser 1100

2MB	n/a	$105	4MB	n/a	$159

Epson ActionLaser 1600

4MB	n/a	$159	16MB	n/a	$609

HP Laserjet 4L

1MB	C2024A	$48

HP Laserjet IIP, III, IIIP, IIID

2MB	33475B	$95	4MB	33477B	$169

HP Laserjet II, IID

2MB	33444B	$95	4MB	33445B	$169

HP Laserjet IISi, 4, 4M, 4Si, 4SiMX, XL300, Deskjet 1200c

1MB	C2063A	$48	2MB	C2064A	$96
4MB	C2065A	$174	8MB	C2066A	$339

HP Laserjet 4P, 4MP, Color Laserjet

2MB	C3151A	$95	4MB	C3152A	$179

HP Deskjet 500, 500C, 520, 520C, 550C, 560, 560C

256K	22707B	$40

HP Designjet 650c Inkjet Plotter

16MB	D2297A	$549

IBM/Lexmark Laser 4019 (all models)

2MB	1058675	$109	3.5MB	1059157	$169

IBM/Lexmark Laser 4029 (all models)

2MB	1183334	$89	4MB	1183335	$159

IBM/Lexmark Laser 4039, 4079 (all models)

4MB	1328665	$159	8MB	1328666	$319

OkiLaser 400

1MB	70014701	$69	2MB	n/a	$109

OkiLaser 400e, 410e

2MB	n/a	$117	4MB	n/a	$197

OkiLaser 830, 840 Plus, 860

2MB	n/a	$124	4MB	n/a	$209

Panasonic LaserPartner 4400, 4420

2MB	KX-PEM1	$110	4MB	KX-PEM2	$204

Panasonic LaserPartner 4410, 4430

2MB	KX-P444	$115	4MB	n/a	$196

Panasonic LaserPartner 4450i, 4420

2MB	KX-P441	$116	4MB	n/a	$189

Texas Instruments MicroLaser XL

1MB	2555739-0001	$49

PERSONAL COMPUTER MEMORY

AST

Premmia GX P/100, P/90

8MB	501565-001	$309	16MB	501566-001	$632
32MB	501567-001	$1,007	64MB	501568-001	$1,999

Premmia MTE, SE P/66

4MB	501159-001	$190	8MB	501159-002	$357
16MB	501159-005	$712	32MB	501159-004	$1220

Bravo 3/S, 4/S, 4/25, 33s

2MB	500510-002	$98	4MB	500510-008	$195

Bravo 3/25s

2MB	500710-004	$89	8MB	500824-002	$304

Advantage! Plus 486DX/33, DX2-50, DX2-66

4MB	501168-001	$179	8MB	500824-001	$304

Advantage! and Advantage! Pro 386SX/20, 25, Bravo 3/33s

2MB	500962-001	$80
8MB	500962-002	$272

Advantage! Pro 486DX/33, SX/25
Bravo LC, LC II, LP and MT

2MB	500987-001	$86
4MB	500987-002	$159
16MB	500987-004	$549
32MB	500987-005	$1089

Premium 386/25, 33, 33T and Premium II 386SX/16, 20, 25

1MB	500780-005, 002	$45

Premium 386/33T, 386SX/16 and Premium II 386SX/20, 25

4MB	500780-004	$188

Advantage! 486/25, 33, 33s, SX20, Premium Server SE 4/33
Power Premium and Premium TE all models
Premium II 386/25, 33, 486/33, 486SX/20

8MB	500780-001	$346

COMPAQ

Presario 500, 700 and 900 series

4MB	147522-001	$159	8MB	147523-001	$319
16MB	147524-001	$549	32MB	147525-001	$1019

ProLiant 2000 and 4000 series, Systempro XL

16MB	149949-001	$715	32MB	149912-001	$1429
64MB	149913-001	$2459	128M	149914-001	$4605

ProLinea 3/25s, 3/33s

2MB	141738-001	$89
8MB	141742-001	$304

Presario 600 and 800 series, ProLinea 4/25, 4/33, 4/50 4/66
ProLinea MT and ProLinea Enhanced series, ProSignia VS

2MB	141683-001	$95
4MB	141684-001	$179
8MB	141685-001	$309

DeskPro 386-20, 25, 386-20e, 25e

1MB Module	115151-001	$62
4MB Module	115152-001	$192

DeskPro 386s/16

1MB Module	113646-001	$62
4MB Module	112534-001	$194
4MB Board	113634-001	$259

DeskPro 3/25i, 33i, 4/25iS, 33i, 66i, 286N, 386N, SX/20, 20N, SystemPro LT and M Series

1MB	118688-001	$49	2MB	118689-001	$95
4MB	118690-001	$170	8MB	118877-001	$356

ProSignia PC Server 486/33, DX2/66

16MB	149320-001	$610	32MB	149147-001	$1152

DeskPro 386-33, 486-33, SystemPro and SystemPro E series

2MB	115144-001	$109	8MB	116561-001	$376

STANDARD SIMMS

30-PIN		72-PIN	
1 x 3-70ns (4-chip/1MB)	$36	512 x 36-70ns (2MB)	$73
1 x 9-70ns (1MB)	$37	1 x 36-70ns (4MB)	$145
4 x 9-70ns (4MB)	$128	2 x 36-70ns (8MB)	$295
16 x 9-70ns (16MB)	$595	4 x 36-70ns (16MB)	$555

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Optiplex ME and V models, PowerEdge XE models
Performance L, M and T models

4MB	310-3325	$159	16MB	310-3327	$549

Power Desktop and Low Profile Power Desktop models

1MB	310-2505	$49			
4MB	310-2507	$169			
16MB	310-2625	$609			

PowerEdge Workstation HE and SE models

2MB	310-2466	$99	4MB	310-2467	$190
8MB	310-2468	$357	16MB	310-2469	$712

Performance ME models

8MB	310-3335	$359	32MB	310-3337	$1220

HEWLETT-PACKARD

Vectra VL2, XP, XU, M2, N2 and XM2 models
Netserver LM, LC and LF models

4MB	D2974A	$179	8MB	D2975A	$356
16MB	D2297A	$609	32MB	D2298A	$1152

Vectra QS and RS models

4MB	D1542 or 1642A	$177

Vectra 386/16A, 20N, 25N models

2MB	D2406A	$89	8MB	D2406A	$305

Vectra 486 M, MI, N, NI and XM models

2MB	D2581A	$95	8MB	D2152A	$354
4MB	D2156A	$179	16MB	D2676A	$611

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Vectra 386/33N, NI models

2MB	D2714A	$92	8MB	D2715A	$304

IBM

Aptiva 300, 500 and 700 series

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Eduquest 55

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Eduquest 50, 40 and 50 models

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PS/1 286 '486SX

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Valuepoint Performance models

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8MB	92G7520 or 73G4132	$354			

PS/1 Consultant, Essential, Expert models x43, x44, PS/V aluepoint all models except Cxx models

4MB	96F9290	$177	16MB	96F9291	$609

PS/1 Consultant, Essential, Expert models

16MB	96F9291	$609

PS/2 25/286, 30/286

2MB	90F5360	$79

PS/2 '55SX, LS '40SX, '50Z, '55SX, LS '65SX, LS '70, XStation

2MB	64S0604	$87

PS/2 '70 A21, A61, B21 B61, PS/V aluepoint Cxx models
PS/1 Consultant, Essential, Expert models

2MB	64S0608	$95

PS/2 35SX, LS, 40SX, 55SX, LS, 65SX, LS, XStation, PS/V aluepoint Cxx models

4MB	56F2935 or 87F9977	$179

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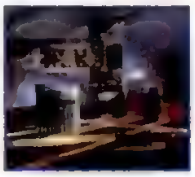

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IBM, Continued

PS/2 55SX, LS, 40SX, PS/V aluepoint

8MB	64S0129	$356

PS/2 90 XP, 95 XP, P75 (pairs) 56, 57 (all) PS/1 Pro M2123

2MB	64S0902	$85

PS/2 90 XP, 95 XP, P75 (pairs) 56, 57 (all models)
PS/1 Consultant, Essential, Expert models, PS/1 Pro M2123

4MB	64S0128	$169	8MB	64S0130	$356

PS/2 80-111, 311, 121, 321 081, 161

2MB	64S0579	$88

PS/2 80 A21, A31, A16

4MB	64S1060	$193

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Ready 425, 433

4MB	n/a	$148	16MB	n/a	$559

PowerMate 386/33i, Express Te, e models

4MB	OP410-6205	$176	16MB	OP410-6206	$610

PowerMate 286/12, SX/16, SX/20

2MB	OP-410-8103	$89

PowerMate 386SX/20i, vi, 16i, 25i, 486/50i, 33i

8MB	OP-410-2101	$304

PowerMate SE Plus

2MB Board	n/a	$215
4MB Board	n/a	$299

PowerMate SX/20

2MB CPU Upgrade	OP-410-8101	$139
2MB Board	OP 410-8102+8105	$176

PowerMate 386/20-25

2MB	APC-H655	$219	8MB	APC-H656	$559

PowerMate 386/16E, 486/25E

2MB	OP-410-5101	$141

ZENITH

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16MB	ME 90	$610

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4MB	ME 100	$179

Z Select 100 models

4MB	AME 00*0	$179	8MB	AME 00*3	$354

Zenith Z 386/20 25, 33, 33E

1MB	ZA3800ME	$49
4MB	ZA3900MK	$179

Zenith Z 386SX/16 and Z 386SX/20

2MB	Z-605 1	$99

Z Server EX and LT models

8MB	ME 432	$459
16MB	ME 102	$610
32MB	ME-442	$1220
64MB	ME-92	$2439

Zenith 486/33ET

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	16MB	$629
PowerExec 3/25SL, 3/25SL-C, EL	4MB	$149
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Premium Exec 386SX/20, 25, 25C	4MB	$160

COMPAQ

Contura Aero 4/25, 4/33c	4MB	$179
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Concerto 4/25, 4/33	4MB	$175
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Contura 3/20, 3/25, 3/25c	4MB	$148
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Contura 400 models	4MB	$185
	8MB	$369
Contura 4/25, 4/25cx, 4/25c	4MB	$169
	8MB	$299
LTE Elite	4MB	$179
	8MB	$319
	16MB	$599
LTE Lite 20, 25, 25c, 25e	4MB	$200
	8MB	$349
	16MB	$729
LTE Lite 4/25c	4MB	$180
	8MB	$339

Everex

Tempo LX Notebook	2MB	$89
STEP Note 486SX/33, 50, 75	16MB	$659

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ThinkPad 230Cs	8MB	$410
ThinkPad 300	8MB	$339
ThinkPad 340, 355, 360, 730	4MB	$169
	8MB	$320
	16MB	$659
ThinkPad 510	4MB	$199
	8MB	$359
ThinkPad 700, 720, 755 and CL57SX	4MB	$199
	8MB	$379
	16MB	$669
	32MB	$1399
ThinkPad 710T	4MB	$179
	8MB	$315
N51 Notebook	2MB	$95
	4MB	$179
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* This graph displays the amount of memory it takes to run Windows & OS/2 applications more efficiently

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UltraLite Versa (all models)	4MB	$189
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	6MB	$329
	8MB	$340
UltraLite SL/20, SL/20P	2MB	$85
	6MB	$279
ProSpeed 286, 386SX/16	4MB	$179
Versa S	4MB	$199
	8MB	$319

Sanyo or Zeos

Notebook Memory	2MB	$89

Texas Instruments

TravelMate 3000 (all models)	2MB	$79
TravelMate 4000 (all models)	4MB	$189
	16MB	$1189

Toshiba

T2000, 2000SX, SXe	4MB	$169
T2200SX, T1800 Series	8MB	$329
T2400	4MB	$185
	8MB	$359
T1200XE, 1600, 3100E	2MB	$89
T3100SX, 3200SX, SXC	2MB	$115
	4MB	$149
T3300SL	4MB	$165
	8MB	$389
T3400	4MB	$185
	8MB	$359
T4400, T6400 (all models)	4MB	$179
	8MB	$339
	16MB	$675
T1900, T4500, T4600, T4700, (all models)	4MB (3.3 V)	$189
	8MB (3.3 V)	$349
	16MB (3.3 V)	$759
T5400, T5200, T5200C, T8500	2MB	$89
	8MB	$349

Zenith

Z-Note 320L, 320Lb, 325L, 325Lc	2MB	$95
	8MB	$298
Z-Note 425 Series	4MB (3.3 V)	$155
	8MB (3.3 V)	$369
Z-Sport 420S, 425S	4MB	$189
Z-Sport 325S	4MB	$189
MastersPort 386SL, SLC, SLe	2MB	$85
MastersPort 386SX	2MB	$85
SupersPort SX, 286e, SlimsPort	2MB	$139
Z-Star	4MB	$159
	8MB	$369

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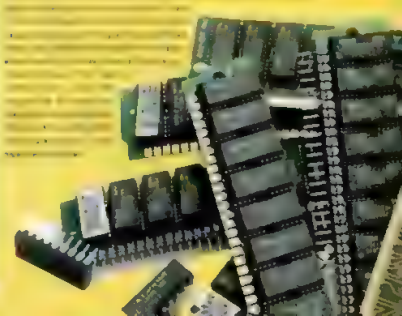

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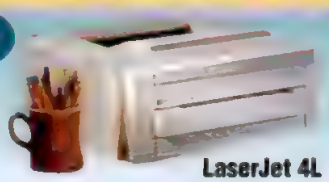

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486DX4/75	340MB	Dual Scan	$3589
486DX4/75	540MB	Active	$4729
486DX4/100	810MB	Active	$5569
486DX4/75	340MB	True Color Active	$4629
486DX4/75	540MB	High Res.	$5099
486DX4/100	810MB	High Res.	$5949

Business Lease: $118/mo.

Versa M

Versa V

- ▲ 4MB expandable to 20MB
- ▲ 2 Type II PCMCIA slots or 1 Type III PCMCIA slot
- ▲ MS-DOS 6.21, Windows 3.1, built-in trackball
- ▲ Removable hard drive
- ▲ Removable floppy – add second battery

Processor	Screen	Hard Drive	Price
486DX2/50	9.5" Dual Scan	250MB	$2499
486DX2/50	9.5" Dual Scan	340MB	$2669
486DX2/50	9.5" Active	250MB	$3249
486DX2/50	9.5" Active	340MB	$3399
486DX2/50	9.5" Active	540MB	$3779
486DX4/75	9.5" Active	340MB	$3879
486DX4/75	9.5" Active	540MB	$4249

Business Lease: $92/mo.

Ready Multimedia Desktops

- ▲ VESA local bus graphics
- ▲ NEC CD-ROM drive
- ▲ SoundBlaster 16 sound card
- ▲ Speakers, headphones
- ▲ Fax modem
- ▲ MS-DOS, Windows, Quicken and more
- ▲ CD titles: Compton's Encyclopedia, PFS Window Works

Processor	Hard Drive	Price*
486SX/33 Desktop	270MB	$1299
486DX2/66 Desktop	340MB	$1479
486DX2/66 Minitower	420MB	$1539
P60 Minitower	420MB	$1999

Business Lease: $50/mo.

**Monitors sold separately.*

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- ▲ SurePoint integrated pointing device
- ▲ 2 Type II or 1 Type III PCMCIA slots
- ▲ Only 4.5 lbs.

Processor	Screen	Hard Drive	Price
486SX/33	9.5" Mono	210MB	$1229
486SX/33	9.5" Dual Scan	210MB	$1429
486SX/33	9.5" Active	210MB	$2179
486DX2/50	9.5" Active	260MB	$2369
486DX2/50	9.5" Active	350MB	$2549

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Versa S

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- 1 Type II and 1 Type III PCMCIA slots
- Accupoint integrated pointing device
- MS-DOS 6.21, Windows for Workgroups 3.11, Windows Sound System 2.0, Indeo Video, and Run Time Video for Windows

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75MHz Pentium

10.4" Active Matrix Color Display

T4900

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- 82-key keyboard
- MS-DOS, Windows 3.1
- Ballpoint mouse with Quickport (T1900s)
- Accupoint pointing device (T2400)
- Enhanced power management

Model	Processor	Screen	Hard Drive	Price
T1910	486SX/33	9.5" Mono	200MB	$1319
T1910	486SX/33	9.5" Dual Scan	200MB	$1779
T1960	486DX2/50	9.5" Dual Scan	200MB	$2159
T1960	486DX2/50	9.5" Dual Scan	320MB	$2329
T1960	486DX2/50	8.4" Active	200MB	$2749
T1960	486DX2/50	8.4" Active	320MB	$2919
T2400	486DX2/50	9.5" Dual Scan	250MB	$2749
T2400	486DX2/50	9.5" Dual Scan	320MB	$2879
T2400	486DX2/50	8.4" Active	250MB	$3299
T2400	486DX2/50	8.4" Active	320MB	$3419

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- Integrated AccuPoint pointing device

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Processor	Screen	Hard Drive	Price
486SX/33	7.8" Active	250MB	$2499
486DX2/50	8.4" Active	250MB	$3469

Business Lease: $92/mo.

T4700, T4800 and T4850

- Brilliant color display with local bus video
- 2 PCMCIA slots (Type II, Type III)
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- MS-DOS, UltraFont, Indeo video compression software, Windows for Workgroups 3.11 and Run Time for Windows

as low as **$3919**

Model	Processor	Screen	Hard Drive	Price
T4700	486DX2/50	9.5" Active	200MB	$3919
T4700	486DX2/50	9.5" Active	320MB	$4199
T4800	486DX4/75	9.5" Active	500MB	$4829
T4850	486DX4/75	10.4" Active	500MB	$5199
T4850	486DX4/75	10.4" Active	772MB	$5569

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T4700

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LANtastic V6.0- 1 User	$79.99
LANtastic V6.0- 5 Users	$329.99
NodeRunner SI 2000C	$74.99
Eagle NE2000T PCMCIA Ethernet	$199.99

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SMART ST1414L
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- ▲ Local bus graphics
- ▲ Pentium upgradable
- ▲ Energy Star compliant
- ▲ MS DOS 6.0, Windows 3.1

Processor	RAM	Hard Drive	Price
486SX 33	4MB	270MB	$1059
486SX2/50	4MB	270MB	$1169
486DX2 50	4MB	420MB	$1379
486DX2 66	4MB	420MB	$1499
486DX2/66	4MB	525MB	$1639
486DX4/100	8MB	420MB	$1999

*COMPAQ color monitors start at $239.99

as low as $1059

ProLinea

LTE Elite

- ▲ 4/8MB RAM exp. to 20/24MB
- ▲ Built-in AC adapter
- ▲ Removable hard drive
- ▲ 2 Type II or 1 Type III PCMCIA slots
- ▲ Integrated trackball
- ▲ MS-DOS 6.2, Windows 3.1, MS Video for Windows Run Time

as low as $3119

Processor	Display	Hard Drive	Price
486DX2/40	9.5" Dual Scan	170MB	$3119
486DX2/40	8.4" Active	170MB	$3779
486DX2/40	8.4" Active	340MB	$4159
486DX2/50	9.5" Mono	250MB	$3299
486DX2/50	9.5" Active	340MB	$4999
486DX4/75	9.5" Active	340MB	$5669
486DX4/75	9.5" Active	510MB	$6139

Business Lease: $103/mo.

LTE Elite

Contura 400

- ▲ 486DX2/40 processor
- ▲ 4MB RAM expandable to 20MB
- ▲ 2 Type II or 1 Type III PCMCIA slots
- ▲ Large built-in trackball
- ▲ MS-DOS, Windows 3.1, Tabworks, Lotus Organizer

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Display	Hard Drive	Price
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- ▲ Enhanced J-Mouse pointing device
- ▲ Built-in AC adapter
- ▲ MS DOS, Windows 3.1 and CoSession Host software
- ▲ 1-Year Z-CARE on-site service

Processor	RAM	Screen	Hard Drive	Price
486DX2/50	4MB	9.5" Mono	200MB	$1699
486DX2/50	4MB	9.5" Dual Scan	200MB	$2179
486DX2/50	8MB	9.5" Dual Scan	340MB	$2549
486DX2/50	4MB	9.5" Active	340MB	$3309

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- ▲ 32-bit VESA local bus video
- ▲ Detachable video display
- ▲ Built-in 16-bit stereo sound with speaker and microphone
- ▲ Integrated trackball
- ▲ Two Type II or one Type III PCMCIA slot
- ▲ MS-DOS, Windows for Workgroups, Microsoft Sound System
- ▲ 3-Year Warranty

Processor	RAM	Screen	Hard Drive	Price
486SX 33	4MB	10.4" Mono	200MB	$2449
486DX2/50	4MB	10.3" Dual Scan	200MB	$2869
486DX2 50	4MB	10.3" Dual Scan	340MB	$3149
486DX2 50	4MB	9.5" Active	340MB	$4339
486DX2/50	8MB	9.5" Active	450MB	$4759
486DX4/75	8MB	9.5" Active	520MB	$5339

as low as $2449

Z-NOTEFLEX ACCESSORIES

FLEXDOCK port replicator	$219.99
FLEXBAY floppy bay battery recharger	$159.99
FLEXSHOW Multimedia Companion	$799.99
FLEXSITE LCD display stand	$199.99

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32Kx8	18.00	9.00	8.00	7.00
32Kx8 (3.3V)	–	–	14.50	–
64Kx1	–	11.00	9.00	8.00
64Kx4	–	11.00	9.00	8.00
16Kx4	–	8.00	7.00	6.00
128Kx8	–	58.00	39.00	29.00

Individual D-RAM Chips

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	120NS	100NS	70NS	60NS	150NS
1Meg× 1	–	8.85	8.45	5.85	4.95
1Meg×4	–	38.00	36.00	34.00	–
1Meg×4 Zip Pkg	–	24.00	22.00	21.00	–
256x4 Page Dip	–	7.25	6.75	6.50	5.95
256 4-Static Dip	–	–	9.95	–	–
256x4 Page Zip	–	8.25	8.00	8.05	–
256x4 Video Zip	–	–	12.95	11.95	9.95
256x8(SOJ)	–	29.00	24.00	–	–
256 x1	–	3.25	2.95	2.75	2.25
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64x1	–	–	–	–	2.00
256x16 SOJ	–	–	39.00	–	–
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CX486 SRX2 20/40	244.00
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2 x 36 8 mg	–	–	359.00	339.00	339.00	–
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	16Meg	500987-004		619.00
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Premium 486/25, 25E, 33, 33E				
Premium 386/33TE, 486/25TE, 33TE				
Prem. Serv. Prem II 386SX/20, 25				
Prem II 386/25, 386/33, 486/33, 486SX/20	0Meg	800780-001		399.00
Premium 386/33T, Prem. 386SX/16	1Meg			
Prem II 386SX/20, 25	4Meg	500780-004	64 pin	189.00
Premium 386/25, 33, 386/33T, 386SX/16	1Meg	500780-003		99.00
Prem II 386SX20,25	4Meg	500780-001		59.00
Premia 4/33S, 4/33, 4/50D, 4/66D	0Meg	501159-002		379.00
Premia	16Meg	501159-003		799.00
Premia	32Meg	501159-004		1499.00
Premia	64Meg	501159-005		3111.00
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MODEL	AMT. UPGRADED	AST PART #	PRICE
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64F ... 4Meg	80-A21 A81 80-A31 80-111 80-311	189.00
64508... 8/16 ... (2Meg)	70-061 E61 121 S02 ...55A 65SA P 70	99.00
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07E1415 (4Meg)	Thinkpad 750, 750c, 755 360, 355, 340, 450	209.00
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86G0094 (16Meg)	Thinkpad 750, 750c, 755 360, 355, 340, 450	849.00
07E1429 (4Meg)	CL57LSX LoFg Thinkpad 700, 700C, 720, 720C	209.00
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92F8804 (2Meg)	R45SL	109.00

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MODEL	AMT. UPGRADED	CMPQ PART #	PRICE
DeskPro 386/33, 386/33L, 486/25, 486/33L, 486/25C, System Pro	2Meg Module	115144-001	109.00
	8Meg Module	116561-001	399.00
	32Meg Module	116569-001	1299.00
DeskPro 386/33L, 486/33L 386/25 386/20	1Exp Bd	116569-001	279.00
	1Meg Module	113131-001	79.00
	4Meg Module	113132-001	199.00
DeskPro 386S-16MHz	1Meg Exp Bd	113633-001	149.00
	4Meg Exp Bd	113634-001	279.00
	1Meg Module	113646-001	79.00
	4Meg Module	112534-001	199.00
DeskPro 386/20E	1Meg Exp Bd	112644-001	149.00
DeskPro 386/25E	4Meg Exp Bd	113645-001	279.00
	1Meg Module	113131-001	79.00
	4Meg Module	113132-001	199.00
DeskPro 286N, 386N, 386SX/20L all "M" series, system LT series, all "I" series	1Meg Module	118588-001	99.00
	2Meg Module	118589-001	89.00
	4Meg Module	118590-001	169.00
	8Meg Module	129877-001	339.00
M Series Exp Bd	0-5 Meg	129160-001	189.00
DeskPro 386/16	1Meg Kit	108071-001	99.00
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DeskPro 286	1-2Meg Exp Bd	108069-001	239.00
DeskPro 5/60, 5/66M, 5/66M ALL OF THESE MODELS	4-8Meg Exp Bd	108070-001	437.00
Prolinea 5/60	512K Kit	113012-001	49.00
Prolient 100 5/60	8Meg Kit	149911-001	399.00
Prolient 2000 4/33, 5/66	16Meg Kit	149849-001	699.00
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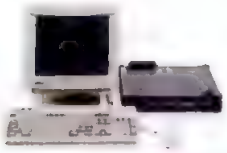

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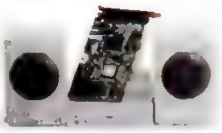

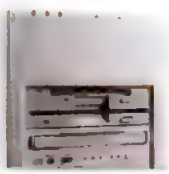

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Xircom Token Ring 16/4	449.18

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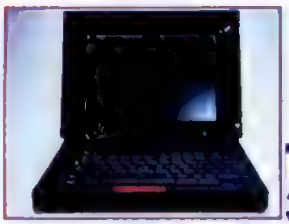

NEW! IntelDX2™ Power!

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ThinkPad® 360 Family

Advanced design...powerful performance

✔ i486SX/33 CPU (360, 360C, 360Cs) ✔ IntelDX2™ 50MHz CPU (360CSE, 360CE) ✔ 4MB RAM std., 20MB max. ✔ 170MB, 340MB or 540MB hard drive ✔ 9.5" monochrome LCD display (360) ✔ 9.5" dual-scan color display (360Cs 360CSE) ✔ 8.4" active-matrix color display (360C, 360CE) ✔ Accelerated local bus video, 1MB RAM ✔ Removable hard drive, battery and floppy drive ✔ PCMCIA, accepts 2) Type II or 1) Type III ✔ Preloaded software: PC-DOS, Windows™, Lotus Organizer and more. ✔ TrackPoint II pointing device

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IBM ThinkPad® 510Cs

50MHz color subnotebook computer

✔ IBM 486SLC2 50/25 Mhz CPU ✔ 4MB RAM Std., 20MB Max. ✔ 200MB hard drive ✔ 1) Type II PCMCIA slot ✔ 7.7" backlit color STN-LCD display, 256 colors ✔ Standard external 1.44MB 3.5" floppy drive ✔ NiMH battery: 3+ hours battery life, includes AC charger ✔ Serial, external floppy, parallel, external VGA ports ✔ TrackPoint II pointing device on keyboard ✔ Pre-loaded IBM PC-DOS V6.3, Windows™, Lotus Organizer and more ✔ Weight: only 4 lbs., with battery ✔ One year international warranty, 24 hr./7 day toll-free assistance

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Versa™ V Series

Superior performance, Versa flexibility and NEC value

Bound to be by everyone's side, the Versa V Series offers superior notebook performance its IntelDX2™ 50MHz power, NEC color display technology, comprehensive desktop docking options and up to 10 hours of battery life combine to make the Versa V Series affordable notebooks with unexpected value

- SL-enhanced IntelDX2™ 50MHz CPU
- 4MB RAM std., 20MB max
- 250MB, 340MB or 540MB hard drive
- User-removable floppy disk and hard drives
- 9.5" dual-scan color display (V/50D)
- 9.5" active-matrix color display (V/50C)
- Local bus video with accelerator
- PCMCIA slots: 2) Type II or 1) Type III
- Expansion options: Docking Station II, port replicator
- Ports: enhanced parallel, serial, CRT, PS/2 keyboard/mouse
- Preloaded MS-DOS® and Windows™
- Front-mounted VersaTrack trackball
- NiMH battery, 3 to 5 hour life
- Accepts optional second battery
- Three-year warranty

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V/50D, 250MB	$2559.87	CDW 44298
V/50C, 250MB	$3307.88	CDW 44299
V/50C, 340MB	$3464.55	CDW 44301
V/50C, 540MB	$3845.18	CDW 44302

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Versa M Series

IntelDX4™ multimedia notebooks

More power and more color than ever before

- IntelDX4™ 75MHz or 100MHz CPU
- Battery-saving 3.3 volt SL-enhanced technology
- 16KB CPU cache, 128KB external cache on 100MHz CPU ◆ 8MB RAM std., 40MB max. ◆ 250MB, 340MB, 540MB or 810MB removable hard drive ◆ User removable/reversible displays
- ✔ *Enhanced dual-scan full color (M/75D) 9.5", 64K colors at 640 x 480*
- ✔ *Active-matrix full color (M/75C, M/100C) 9.5", 64K colors at 640 x 480*
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- ✔ *Active-matrix true color (M/75TC, M/100TC) 9.5", 16M colors (24-bit) at 640 x 480*
- High-performance local bus video with graphics accelerator ◆ Simultaneous external monitor support ◆ PCMCIA slot, two Type II cards or one Type III card ◆ Integrated 16-bit audio with built-in speaker and microphone ◆ Ports: serial, enhanced parallel, audio in/out, external CRT, PS/2 keyboard/mouse, expansion bus ◆ VersaBay holds 3.5" floppy drive (standard) or optional Video, PCMCIA, or 2nd battery Paks ◆ NiMH smart battery, up to 5 hours life ◆ User-selectable power management functions ◆ Front-mounted 16mm VersaTrack trackball ◆ Pre-loaded software: MS-DOS® Windows™, Windows Sound System and more ◆ Three year warranty

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M/75D, 250MB	$3483.77	CDW 45881
M/75D, 340MB	$3656.77	CDW 45883
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M/75C, 540MB	$4798.22	CDW 45885
M/100C, 340MB	$4749.85	CDW 45887
M/100C, 810MB	$5652.07	CDW 45888
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M/100HC, 540MB	$5459.34	CDW 45890
M/100HC, 810MB	$6035.56	CDW 45891
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100 MHz PERFORMANCE SERIES

I
- Am486™DX4-100 processor
- 256K write-back cache
- Diamond Stealth 64 PCI (1MB)
- 2X CD-ROM Drive, 3.5" floppy drive
- Microsoft Mouse, 101 keyboard
- MS-DOS & Windows for Workgroups
- Transporter Menu System
- 3 Year Parts & Labor On-Site

A
- 8MB RAM, 540MB IDE hard drive
- 15" PerComp™ .28DN, 28dp
- Microsoft Works Multimedia CD

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B
- 8MB RAM, 720MB IDE hard drive
- 15" PerComp™ .28DN, 28dp
- Microsoft Works Multimedia CD

$1,869

C
- 16MB RAM, 1GB hard drive
- 17" PerComp™ .28DN, 28dp
- Microsoft Office Professional v4.3 CD
- Microsoft Encarta
- Sound Blaster 16 & Speakers

$2,999

II
- Am486™DX4-100 processor
- 256K write-back cache
- Diamond Stealth 64 PCI (2MB)
- 4X CD-ROM Drive, 3.5" floppy drive
- 16-Bit sound card with premium speakers
- Microsoft Mouse, 101 keyboard
- MS-DOS & Windows for Workgroups
- Transporter Menu System
- 3 Year Parts & Labor On-Site

A
- 8MB RAM, 540MB IDE hard drive
- 15" PerComp™ .28DN, 28dp
- Microsoft Works Multimedia CD

$2,049

B
- 8MB RAM, 720MB IDE hard drive
- 15" PerComp™ .28DN, 28dp
- Microsoft Works Multimedia CD

$2,459

C
- 16MB RAM, 1GB hard drive
- 17" PerComp™ .28DN, 28dp
- Microsoft Works Multimedia CD

$2,899

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- MS-DOS & Windows for Workgroups
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Am486™DX2-80 $1,699 #012005

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4MB RAM
- 420MB 14ms IDE hard drive
- 1MB graphics accelerator
- 14" PerComp™, 1024NI, .28dp
- Microsoft Works Multimedia CD

Am486™DX4-100 $1,429 #013003

Am486™DX2-66 $1,289 #013001

Am486™DX2-80 $1,329 #013002

8MB RAM
- 730MB 12ms IDE hard drive
- 1MB graphics accelerator
- 15" PerComp™, 1280NI, .28dp
- Microsoft Works Multimedia CD

- Am486™DX2-66 processor
- 256K Write-back cache RAM
- 2X CD-ROM drive, 3.5" floppy drive
- 16-bit sound card and speakers
- Microsoft Mouse, 101 keyboard
- MS-DOS & Windows for Workgroups
- Microsoft Home bundle pack Encarta, Works Multimedia, Money, Dangerous Creatures, Arcade & Best of Windows Entertainment Pack
- Transporter Menu System
- 3 Year Parts & Labor On-Site

Am486™DX2-66 $1,999 #012007

Am486™DX2-80 $2,049 #012008

Am486™DX4-100 $2,149 #012009

8MB RAM
- 420MB 14ms IDE hard drive
- 1MB graphics accelerator
- 14" PerComp™, 1024NI, .28dp

Am486™DX4-100 $1,649 #012003

Am486™DX2-66 $1,499 #012001

Am486™DX2-80 $1,549 #012002

16MB RAM
- 730MB 12ms IDE hard drive
- 1MB graphics accelerator
- 15" PerComp™, 1280NI, .28dp

ADVANCED
S E R I E S

- Am486™DX2-66 processor
- 256K Write-back cache RAM
- 2X CD-ROM drive 3.5" floppy drive
- 16-Bit sound card with premium speakers
- Microsoft Mouse, 101 keyboard
- 14.4 Internal Fax/Modem
- Transporter Menu System
- 3 Year Parts & Labor On-Site

8MB RAM
- 540MB 12ms IDE hard drive
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- 15" PerComp™, 1280NI, .28dp
- Choice of (2) Lotus Applications Lotus 123, AMI Pro, Freelance, Approach or Organizer

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Am486™DX2-66 $1,849 #013001

Am486™DX2-80 $1,899 #013002

16MB RAM
- 730MB 12ms IDE hard drive
- Diamond Stealth 64 PCI (2MB)
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American Power BK450 BK600	185/249
[illegible] BK900 BK1250	359/485
[illegible] AP400 AP600	279/334
[illegible] AP900	469
[illegible]	539
American Power AP1250	619
American Power UPS 220V Models	CALL
Tripp Lite BC250 BC400	95/145
Tripp Lite BC500 500 LAN	173/179
Tripp Lite BC600 LAN 750 LAN	229/289
Tripp Lite BC900 LAN 1250 LAN	339/439
Tripp Lite Omni 500 LAN/600 LAN	239/275
Tripp Lite Omni 750 LAN 1250 LAN	336/545
Tripp Lite LC1200 LC1800	139/187

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AST Bravo MS 486DX2/66 270M 8m	1589
AST Premmia MX Pentium 60 420M 8m	2499
AST Premmia GX Pentium 90 365 8m	3579
Compaq Prolinea 486SX-50 250M	1179
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Adaptec 2940 PCI SCSI Master	389

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Intel 486SX 25 to 50 Overdrive	179
Intel 486DX 33 to 66 Overdrive	235

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Conner 850M 12ms 3.5" IDE	379
Conner 1.275G 12ms 3.5" IDE	579
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Maxtor 340M 14ms 3.5" IDE	199
Maxtor 540M 14ms 3.5" IDE	289
Micropolis 4410 1G/2217 1.7G	579/999
Seagate ST3290A 280M 16ms IDE	185
Seagate ST3391A 341M 12ms IDE	199
Seagate ST3491A 428M 14ms IDE	209
Seagate ST5660A 545M 12ms IDE	289
Seagate ST3780A 720M 13ms IDE	339
SyQuest [illegible] int 88 ext	399/459
SyQuest Parts 88M ext	439
Teac FD505 dual floppy drive	109
Teac / Toshiba Floppies	ALL 85

DIGITIZERS

Calcomp Drwg Brd III 12x18 16-button	579
Kurta XGT 6x9 w/ interface	239
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Wacom ArtPad 4x5	147
Wacom Art2 6x8	325

PLOTTERS

Calcomp Designmate 3024S	1479
Hewlett Packard	ALL

NOTEBOOK COMPUTERS

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AST Ascentia DX4/75 340M Color	3189
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Sharp PC-8690 320M 10/4 Actv Clr	4699
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TI TM4000M DX2/50 340M Actv Clr	3029
TI TM4000M DX2/50 455M Actv Clr	3619
TI TM4000M DX/75 340M Actv Clr	4957
TI TM4000M DX4/75 455M Prev Clr	3949
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Toshiba T4650CT DX/75 500M Actv Clr	5169

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CTX 14" 1024x768ni .28mm	229
CTX 14" 1024x768ni MPRII .28mm	259
CTX 15" 1280x1024ni MPRII .28mm	318
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Goldstar 1460DL 14" 1024x768 .28	235
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Idek MF-8221 21" 1600x1200 .28	1899
Idek MF-8221 21" 1600x1200 .26	1939
Idek MF-8621 21" 1600x1200 .26	2299
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Mag DX17F 17" 1280x1024 .26	619
Mag MDP17F 17" 1280x1024 .26	779
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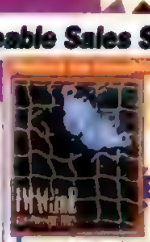

[illegible] and Visual Basic [illegible] Supports Viewing, Printing, Scanning, OCR, Annotations (Hilites, Notes), Forms Overlays, Image Cleanup (De-Skewing, De-Shading and more) and a host of other [illegible]

HARDWARE

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USR Sportster 28.8 V.34 int/ext	229/245
USR Courier V.34 int/ext	389/419
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USR Sportster PCMCIA 2.1 28.8 w/fax	349
USR Courier PCMCIA 2.1 14.4 w/fax	349
USR Courier PCMCIA 2.1 28.8 w/fax	399
ZoomVFP28I 28.8 w/fax int	145
Zoom VFX28I 28.8 w/fax ext	174

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Colorado Jumbo 250 Jumbo 350	152/169
Colorado Trakker 250/Trakker 350	289/319
Colorado Trakker 700	475
Colorado Powertape 1GB int	629
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Avec 2400 Designer	589
Hewlett Packard ScanJet IIP greyscale	349
Hewlett Packard ScanJet IICX Color	799
Hewlett Packard ScanJet IIIP greyscale	489
Hewlett Packard ScanJet IIICX Color	999
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Nikon Cool Scan LS-10E PC ext	1849*
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CD-ROM KITS

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Creative Labs Omni CD int	345
Creative Labs Omni CD4X int	409
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SoundBlaster AWE 32	264
SoundBlaster 16 MCD	139
SoundBlaster 16 ASP MCD	169
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Turtle Beach Multisound Tahiti	242
Turtle Beach Multisound Monterey	329
Turtle Beach Audio Adv PCMCIA	124
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TrueVision Video VGA16	759
TrueVision Targa+ 16 64	1089 1569
Sigma Real Magic VGA	369
Sigma Real Magic SCSI	415

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Chinon CDS535 220ms SCSI-2 int	206
Chinon CDS535 220ms w/contrl	249
NEC MultiSpin 2vx2v	175/242
NEC MultiSpin 3xp	469
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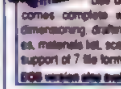

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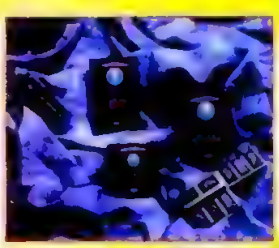

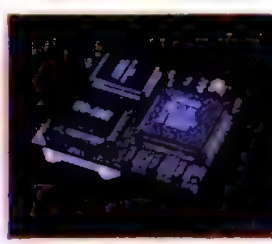

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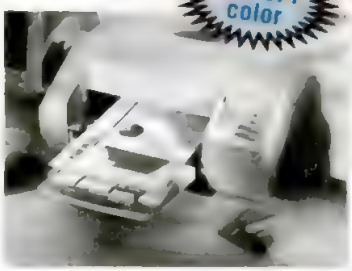

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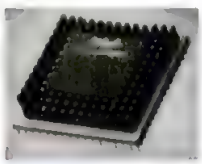

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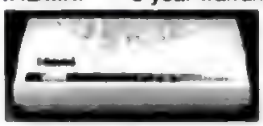

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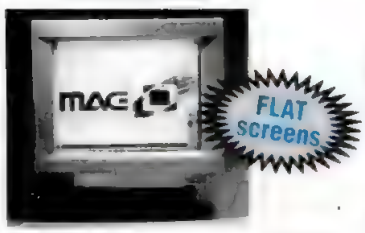

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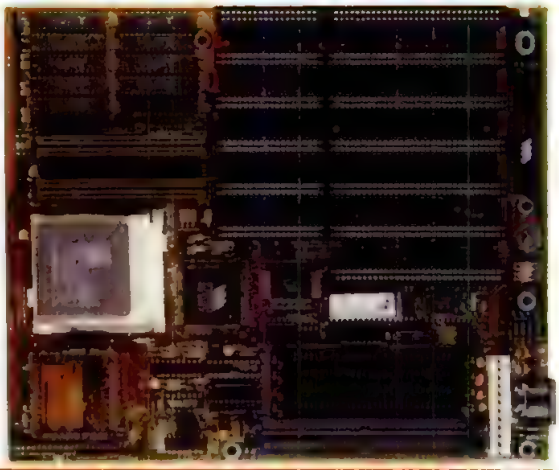

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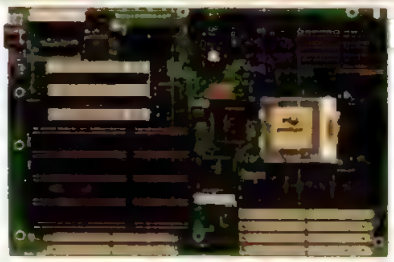

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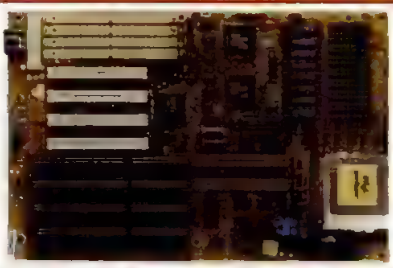

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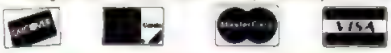

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- 2X CD-ROM drive, 3.5" floppy drive
- 16-bit sound card and speakers
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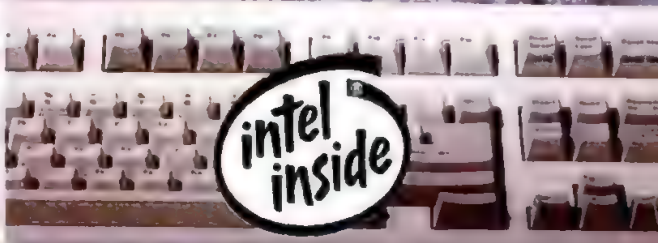

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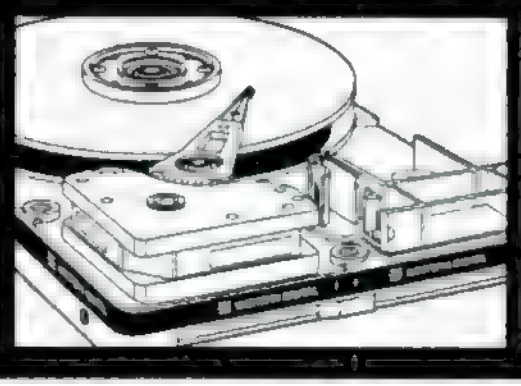

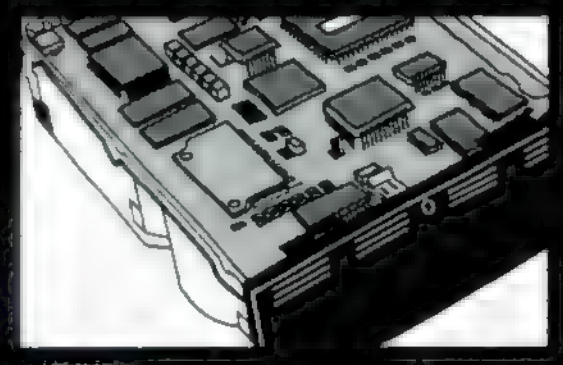

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420MB	14ms	CFS420A	$198
850MB	10ms	CNR850A	$359
1275MB	9ms	CNR1275A	$539

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270MB	12ms	M7270AV	$162
420MB	12ms	M7420AV	$195
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731MB	11ms	LT730A	$295
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4-10Gig	Conner	4326	$959	$1089
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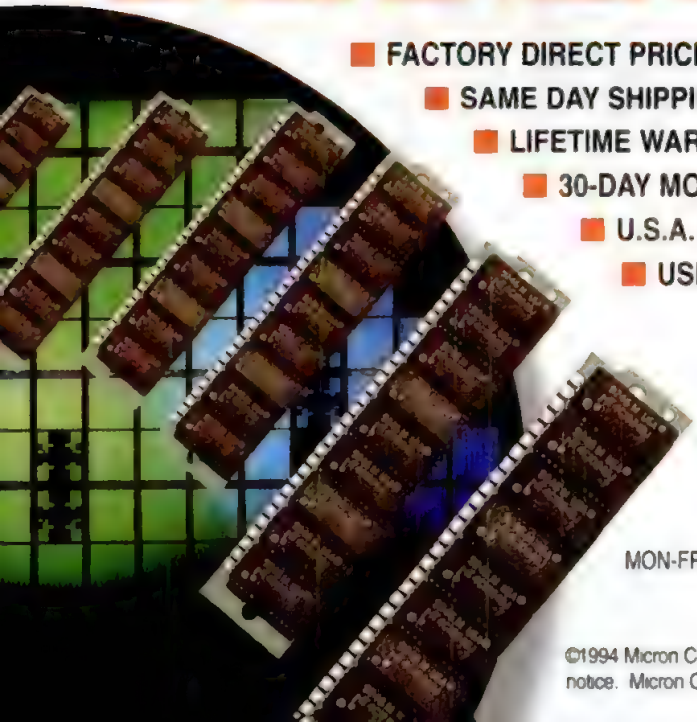

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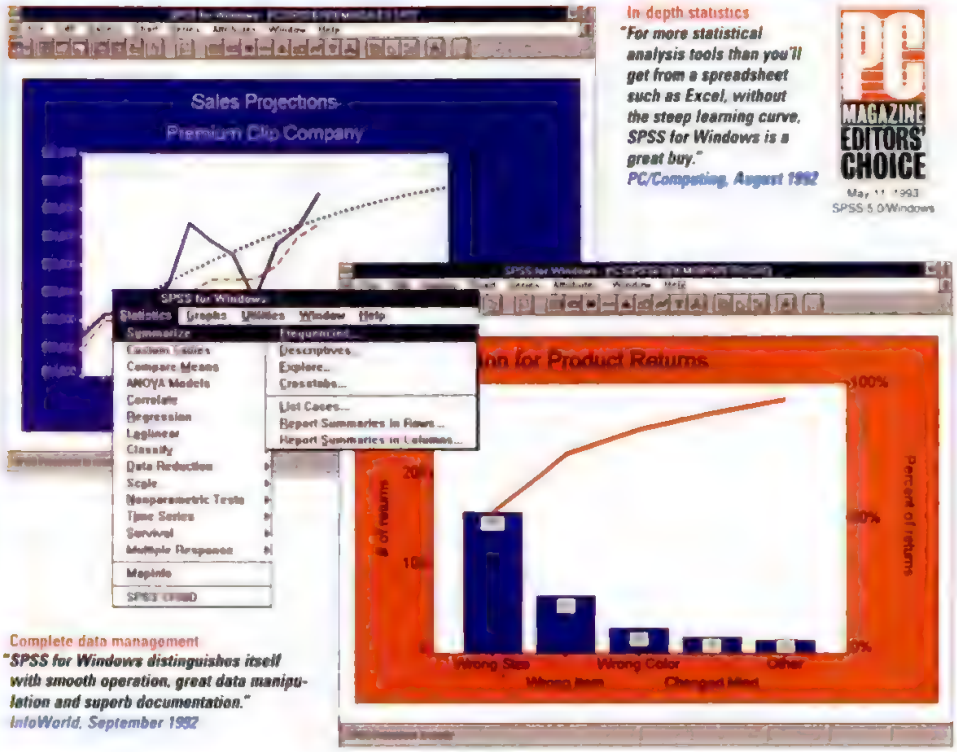

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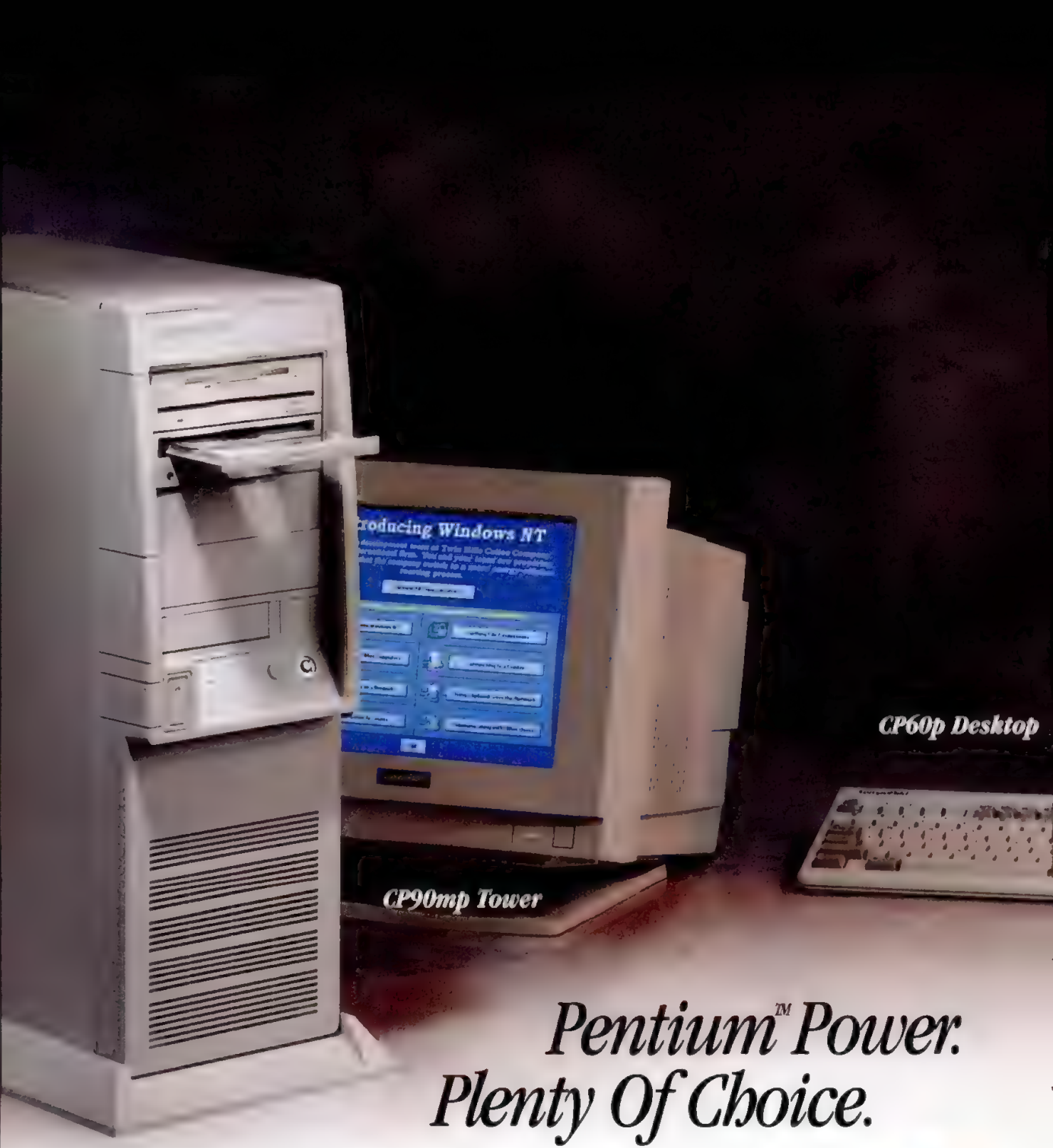

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Monitor	15" N-I	15" N-I	14" N-I
Video	1MB PCI	1MB PCI	1MB PCI
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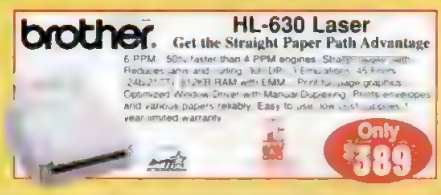

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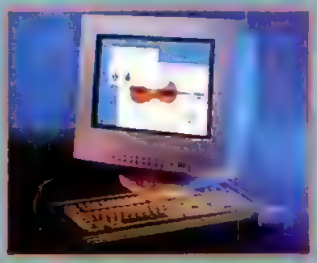

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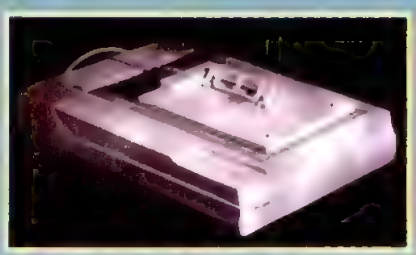

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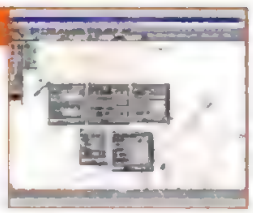

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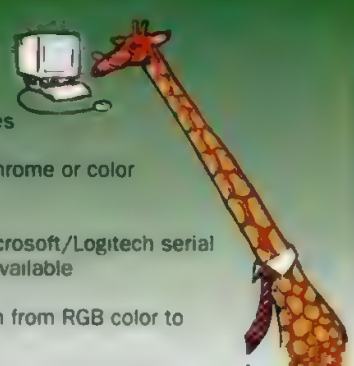

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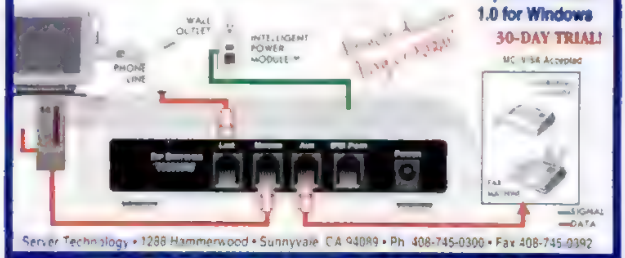

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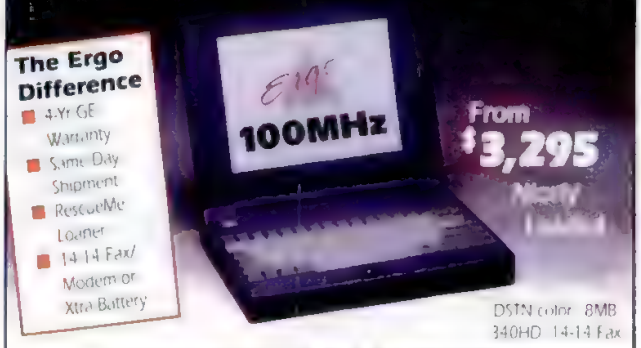

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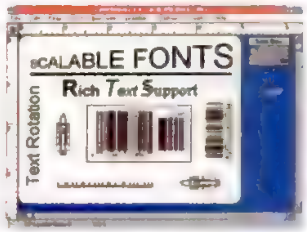

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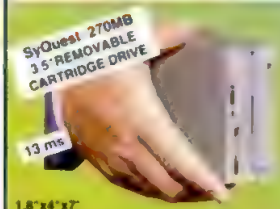

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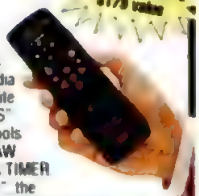

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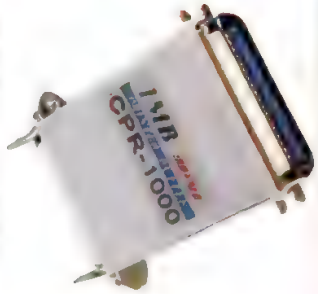

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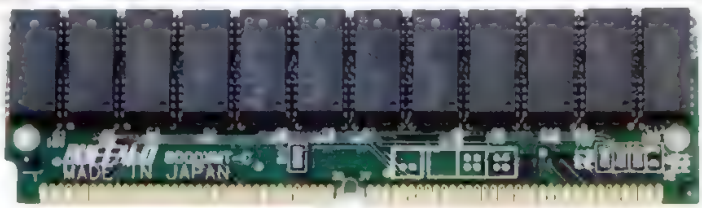

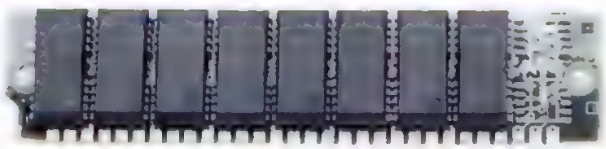

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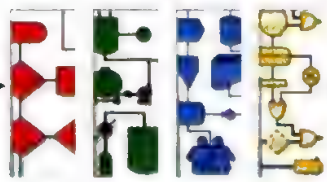

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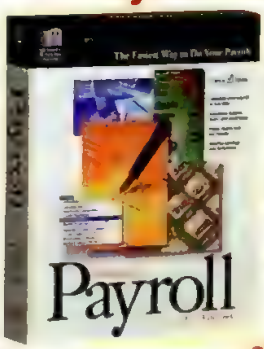

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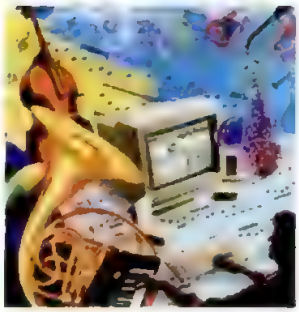

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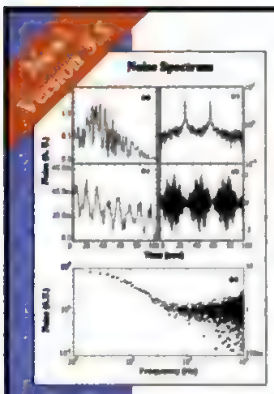

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CFA540A	540MB	12MS	IDE	$268
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MC2217S	1750MB	10MS	SCSI	$908
MC1926	2100MB	11MS	SCSI	$1378
MC1936	3020MB	11MS	SCSI	$1968
MC1936AV	3000MB	10MS	SCSI	$2018
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80387 SX20		80287-10MHz	$49
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80387SL		80287-XT	$78
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T1000 SE/LE/XE	2MB	PA8312U	$73
T2000 / T2000SX	2MB	PA8317U	$73
T2000SX/T1000 LE	4MB	PA83 4U	$188
	8MB	PA83 8U	$338
T1200 XE	2MB	PA8306U	$98
T1600	2MB	PA8307U	$98
T2000 SX/T2200SX/T1800 T1850, C	2MB	PA2000U	$78
	4MB	PA2001J	$188
	8MB	PA2002U	$358
T3100	2MB	PA7139E	$138
T3100 E	2MB	PA8341U	$108
T3100 SX	2MB	PA8308U	$108
	4MB	PA83 0U	$186
T3200 SX	2MB	PA8307U	$118
	4MB	PA8309U	$198
T3200 SXC	2MB	PA8318U	$108
	4MB	PA8319U	$198
T3200	2MB	PA7137U	$184
T5200/66	2MB	PA2006U	$118
	4MB	PA2007U	$218
T3400CT	6MB	PA2008U	$256
	16MB	PA2009U	$698
	4MB	PA20 9V	$188
T4400 SX, SXC, T6400 SXC, DXC	2MB	PA2020V	$268
	16MB	PA2021V	$758
	2MB	PA2003U	$125
	4MB	PA2004U	$198
	8MB	PA2005U	$358
	16MB	PA2013U	$698
	32MB		$1548
T5200 100/120/166DX (133VOLTS) T4700	4MB	PA2012U	$198
	8MB	PA2013U	$388
	16MB	PA2014U	$728
T5100	2MB	PA8301U	$84
T5300/T5200C/T6500/T5400	2MB	PA8304U	$109
	8MB	PA8313U	$418

Compaq Laptop & Notebook Memory

	4MB $186	8MB $258	*8MB $698
Contura 320, 325 C	2MB	139497-001	$98
	4MB	139498-00	$174
	8MB	139499-001	$318
Contura 4/25Ct	4MB	146520-001	$178
	8MB	146521-001	$338
	16MB	146522-001	$718
SLT/286	1MB	110235-001	$75
	4MB	110237-001	$218
SLT/386	1MB	118303-001	$79
	2MB	118304-00	$108
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Lte 386	1MB	137081-001	$79
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	4MB	137081-004	$178
	8MB	21 25-00	$98
	4MB	121125-002	$208
Lte Lite/20, 25, 25C	2MB	29769-00	$138
	4MB	129769-002	$208
	8MB	129769-003	$388
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	4MB	142337-002	$178
	8MB	142337-003	$348
	16MB	142337-004	$718
Aero 3.3mb	4MB	90532-001	$188
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MODEL	MEMORY	PART#/PRICE
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	8MB	N/A $228
AmBIA Enterprise 486, Hurdle 486, Sonata 486 (all models)	4MB	N/A $178
	16MB	N/A $648
P5/1 and 386/SX (3121)	2MB	9299935 $88
	4MB	9299496 $178
P5/2 20/286,25/286, Adapter Ind 1497259	512K	30F3368 $25
	2MB	30F5360 $80
P5/2 295X, LS, 405X,70-E61, D61, 121, Adpr Ind 6450609 34F3011, 34F3077, 502, 555X, 655SX, P70, 595, 6345 X Station 120 & 130	1MB	6450603 $39
	2MB	6450604 $84
P52 50, 30Z, 555X, 60, 65SX	2-8MB	1497259 $198
	1-16MB	6450609 $84
P5/1 Consultant Essentials & Expert models w2, w4 & P5/Volksxpert all models except Con series	4MB	9699290 $174
	16MB	9699291 $398
P5/2 70-A21 A61, B21, B61, P5/1 Consultant Essential & Expert models w11 w13 & w14, P5/Volksxpert Con series	1MB	6450603 $39
	2MB	6450608 $88
P5/2 595X, LS, 405X, 559X, LS, 65SX, P5/2 90 XP, 95 XP, P75 (Point), 56 57 (all) 76, 77 P5/1 Pro 2123	4MB	34F3933 $168
	2MB	6450902 $84
P52 90, 95 XP, P75 (Point) 56, 57, (all) P5/1 Consultant Essential, Expert w11, w13 & w14, P5/1 Pro 2123, 85/6000	2MB	6450728 $174
	8MB	6450730 $338
	8MB	6450729 $338
P52 70's and 80's	2 6MB	6450605 $297
32 BIT BOARDS	2-16MB	34F3077 $225
32 BIT BOARDS	4 16MB	34F3031 $318
P5/2 80-A21 A31 A61	8MB	6451060 $188
P5/2 80-041	8MB	6450375 $79
P5/2 80-111, 311 121, 321, 081 161 d010 80C/8000/Amb 5960 d013/5946 $1398, d016/6060 $2298	2MB	6450379 $94

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	8MB	33G9289 $368	
Thinkpad 350, 350C, 360 P5/NOTE	8MB	6060378 $338	
	16MB	6060379 $647	
Thinkpad 300, 510CS, 2618	4MB	81B9098 $198	
	8MB	81B9099 $388	
	16MB	$868	
CL57SX	4MB	07G1420 $208	
Thinkpad 700, 700C 730 720C, 750C	8MB	07G 421 $378	
	16MB	6665109 $898	
Thinkpad 710T	4MB	N/A $186	
	8MB	N/A $318	
P5/Note MASEL	2MB	9299004 $108	
P5/2, N51 SLC, SX	2MB	07G 126 $98	
	4MB	07G1827 $188	
	8MB	07G 828 $418	
Laptop: N33SX, LADSA & P5NOTE 82	2MB	79F9099 $98	
	4MB	79F1000 $184	
L40SX, P5NOTE 182 ONLY	8MB	79F1001 $358	

Laser Printer Memory

MODULE				
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Epson Action Laser II 8000	$88		$198	$268
Epson + 6000 and many more		$128	$198	
Epson Action Laser 1000 & 1500		$118	$218	$298
Pacific 7100 & 7200	$199	$279		
HP Deskjet 500, 500C, 510, 560C and 660			$38 (256K)	
HP 2 3D		$99	$164	
HP 3 3D 3P 2P 2P+		$98	$168	
HP Laser Jet A 35 3D,1000 1200C		$84	$168	$318
IBM Laser 4019 40?PE (3.5MB)		$178	$164	
IBM Laser 4029 ALL MODELS		$95	$155	
NEC 90, 290		$104		
NEC 95		$88		
OKI 400	$68	$88		
Packard Bell PB9500		$175	$308	
Panasonic 4410/4430		$118	$174	
Panasonic 4420/4450		$118	$178	
Panasonic 4450	$98			
Panasonic 4400/5400		$129	$198	
QMS 410	$119	$159	$269	
Toshiba Page Laser 6		$99	$168	
TI 10,/PS17/PS35	$64	$98		

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80486 DX/33	$158	80486 DX4/100 $548
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AST PREMIUM EXEC 4MB	$173
AST POWEREXEC 325SL/433SL 4MB	$146
AST PREMMIA GX 8MB-16MB	$322/$568
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DECpc 425SE/433SE 4MB-16MB	$194/$709
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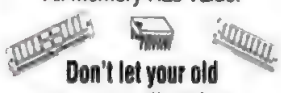

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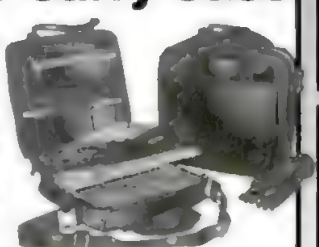

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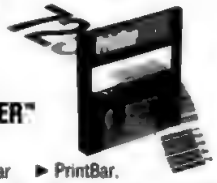

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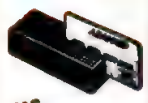

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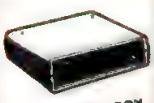

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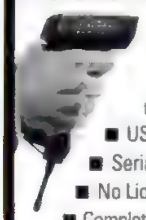

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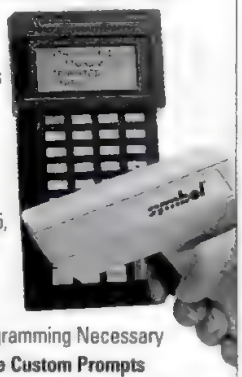

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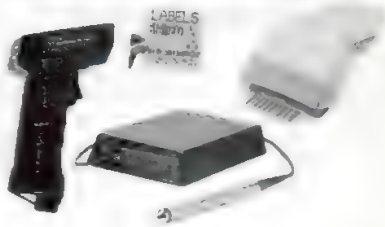

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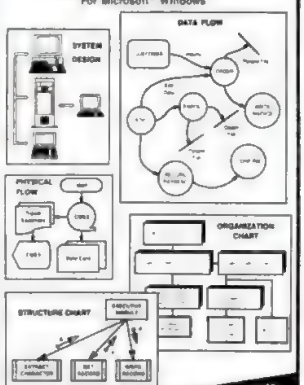

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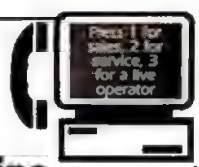

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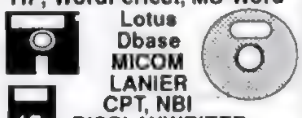

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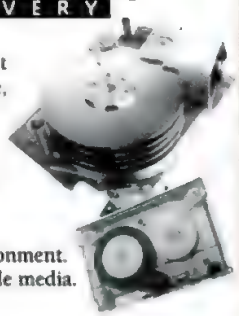

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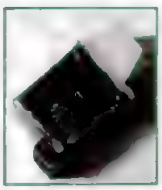

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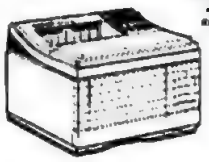

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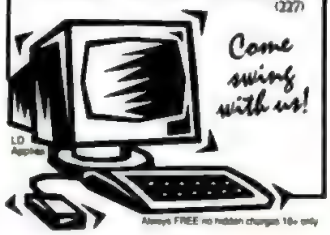

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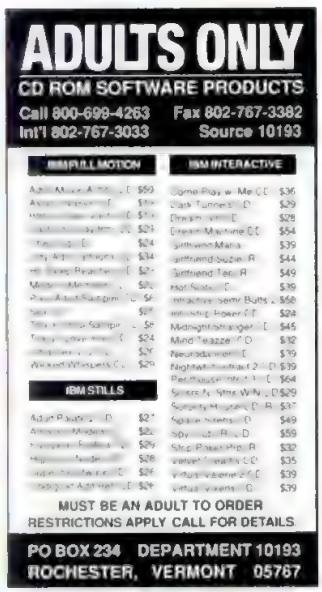

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PC MAGAZINE

Coming Up

Special Report: Electronic Publishing

Electronic publishing creates documents that may never see the printed page—and usually nobody cares. That's their beauty: The information remains fluid, live, and vital. This special report explores a variety of solutions, each with its own set of authoring or editing, resource, and accessory demands. We help you navigate the categories: SGML, HTML, hypertext authoring tools, and portable document tools.

Web Browsers As part of our electronic publishing report, we look at browsing published information on the Internet's World-Wide Web server. NCSA Mosaic started the revolution by allowing users to make data searches via hypertext links stored on special servers. Now myriad software applications offer the same thing—and lots more. Tune in while we review ten Web browsers that promise to untangle the arcana of the Internet.

Tape Backup

If your system goes down irrecoverably, how far would that set you back? Days? Weeks? Months? Maintaining a complete and current backup of your entire hard disk can save you headaches (and heartaches) should the unthinkable happen. We look at the current crop of easy-to-use QIC-3010 and QIC-3020 tape backup systems for standalone PCs, and we also provide an overview of other tape and removable drive options—from DC-6000 to Bernoulli to SyQuest drives.

Color Flatbed Scanners

Not too long ago, color desktop scanners were beyond the reach of most people. Today, the price difference between monochrome and color is so small that even users who might just dabble are opting for color units. We test 16 color scanners ranging from $699 to $3,495 and let you see where each stands in the color spectrum.

Object Orientation

You hear about object-oriented programming languages, object-oriented operating systems, object-oriented user interfaces, even object-oriented applications. But what does object-oriented really mean? For that matter, what is an object? To help you sort fact from fiction, our Tutor column tells you what's object-oriented and what's not—and how object-based technologies will influence our desktops in coming years.

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After Hours

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PC, Read with Me

There's nothing kids love more than books. And whether it's the first or hundredth time through a tale, each turn of the page brings new excitement for a child. Nowhere is this more true than in the latest crop of PC-based electronic storybooks.

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Arthur's Birthday

★★★★ WIN 4-10 $40

Harry and the Haunted House

★★★ WIN 3-8 $40

Living Books, 800-521-6263.

Circle 487 on reader service card

A party crisis between two friends who share the same birthday and a lost ball hit into an abandoned house are the plot conflicts behind the two newest entries in the well-established Living Books series.

Arthur's Birthday, by Marc Brown, is the second Living Book featuring Arthur the Aardvark; in case you've forgotten, Arthur made his first appearance in Arthur's Teacher Trouble. Here, Arthur and his friend Muffy have both scheduled their birthday parties for the same day; their friends are torn over which party to attend. Finally, Arthur devises a solution and, with the help of his friend Francine, arranges a surprise party for Muffy. In the end, everyone's happy at the joint party, and readers have explored 13 pages of music, animations, and hidden surprises including a bird that roars loudly enough to turn a lion into a cowering pussycat, dancing pieces of French toast, and cake decorations that turn into a carousel.

Harry and the Haunted House is the first Living Book written by Mark Schlichting, who originated the concept of Living Books. In this one, Harry hits a baseball too far during a game with his friends, and it lands inside a scary-looking house that they are all convinced is haunted. As they bravely go into the house to search for the ball, they hear many eerie sounds that make their imaginations run wild until they discover the truth. Flying ghosts turn out to be flapping curtains, the mysterious being that grabs Harry's shoulder is only his friend Stinky, and the monster dragging one foot is only Harry's dog Spot scratching a flea. When all is said and done, the "haunted house" turns out to be nothing more than a product of the children's overactive imaginations.

Both these Living Books allow a child to choose to read the story and explore it or to have the story read aloud to them. Kids can choose to read the story in English or Spanish; a printed version of the book is included for non-PC reading.

Celebrate with Arthur's Birthday.

There's nothing to scare kids in the hilarious Harry and the Haunted House.

As with all the titles in this series, these Living Books offer numerous hidden hot spot animations, songs, and sight gags that are uncovered with a click of the mouse. As an added benefit, the Harry and the Haunted House CD-ROM contains nine original songs that can be played on audio CD players.

Living Books are also known for the lessons they help teach young children: Arthur's Birthday reveals the rewards of sharing, and Harry and the Haunted House helps children learn to separate fantasy from fact.

Both books can be enjoyed by any child old enough to click a mouse, but a more sophisticated story line makes Arthur's Birthday better suited to a slightly older audience.

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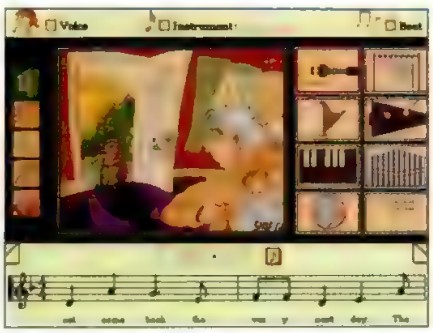
The Cat Came Back

Sanctuary Woods Multimedia Corp., 800-245-4525, 415-286-6100.

Circle 490 on reader service card

★★★★ WIN 4.7M $39.95

What if you had a cat you couldn't give away? Every time you thought you'd found him a home, he came right back to you. That's the premise behind this engaging program, part of Sanctuary Woods' i-Learn series.

The Cat Came Back helps children learn and explore in four different activity areas, all of which are tied to the cat theme. Children can listen, read, sing, or write along with the story line. Kids can even choose a male or female narrator and decide whether to hear the story in English, Spanish, or French.

You can choose which instrument you'd like to hear play The Cat Came Back.

In addition to the story, there are activities to keep the fun flowing. In the Sing-Along section, kids can hear the song played on a variety of instruments (including a guitar and a steel drum), have the song sung to them, or record their own voice singing the song. In the Write-Along section, young readers gather clues to solve the mystery of where Mr. Johnson sent his cat and then write diary entries about their detective work. Kids can use the program's art to create and print their own stories—pictures, words, and all.

In the Read-Along section, kids can explore the attractive hot-spot animations hidden on the various pages, as well as learn new words and their definitions while reading the story. As in the Living Books, there's a hidden animation for kids to find on each page. The program also includes a printed activity book that tests kids' knowledge of what they've just read.

There may be no lesson to learn, but that's no drawback. The program is loads of fun and keeps kids interested for hours. One word of warning: The theme song can become addictive.

PROBLEM SOLVER

Each of the Living Books titles has a surprise animation hidden in a different place on every page. In Arthur's Birthday, click around till you find the party horns; in Harry and the Haunted House, you're looking for a spider.

Club KidSoft CD-ROM

CD-ROM PICK HIT

If you've ever bought expensive software for your kids only to find they hated it, Club KidSoft CD-ROM might provide the answer you've been waiting for. This software club and magazine combination gives you more than 30 interactive demos of popular titles for kids, including a couple of titles reviewed here; if your little one spots a game that catches her fancy, you can help her download the complete version or call a toll-free number to purchase it.

In addition to the demos, this latest issue of the CD-ROM includes a ClubRoom where kids can enter a contest, listen to a song, or browse through winning stories and illustrations by previous contest winners. There are no games or hands-on activities, however.

A $29.95 annual club membership gets you quarterly CDs and magazines; single issues are also available.

—Gayle C. Ehrenman

KidSoft Inc., 800-354-6150.

Circle 492 on reader service card

★★★ WIN 4.7M $29.95

Somebody Catch My Homework

Discis Knowledge Research, 800-567-4321.

Circle 491 on reader service card

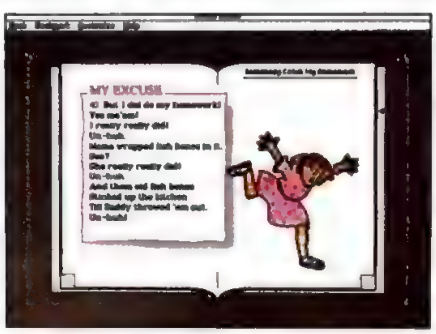
★★★ WIN 4.7M $29.95

Somebody Catch My Homework is a 49-page electronic storybook that contains 19 poems written by David L. Harrison. These poems cover important moments in a child's life, such as reading a book alone for the first time, facing a schoolyard bully, or making up an excuse for not having done the assigned homework. Some poems explore a child's everyday problems. For example, "A Better Answer" muses on how to handle the class know-it-all. Other poems, such as "My Advice," are humorous romps through fantasy.

The poems flow well and are easy for children to read. One particularly appealing option allows children to read the poems themselves before the program reads them aloud. Children can choose to have the program read to them in either a child's voice or in Harrison's own voice. The poems will delight children and will bring back many memories for parents; school tests and unidentifiable lunch foods seem to be timeless parts of growing up.

Although Somebody Catch My Homework may not include the high-impact animations and sounds of other electronic storybooks, it does have a focus on serious study that will appeal to many parents. The program guide that comes inside the jewel case suggests ways to help children relate the poems to their lives.

—Charles Taft



Somebody Catch My Homework captures childhood dilemmas in verse.

Introducing Simply House.™ The Home Improvement CD With Everything From Soup To Nuts.

If you're a do-it-yourselfer with an appetite for knowledge, Simply House is the CD-ROM for you. Based on *The Stanley Complete Step-by-Step Book Of Home Repair And Improvement*, it's a veritable smorgasbord of information. From sealing basement walls to insulating the attic, Simply House covers nearly any project you can think of.

Hundreds of illustrations make every job easier.

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What's more, interactive point-and-click capabilities let you access information quickly and easily. Find the topic you're looking for simply by clicking in the area of interest on the floorplan, or use the alphabetized index.

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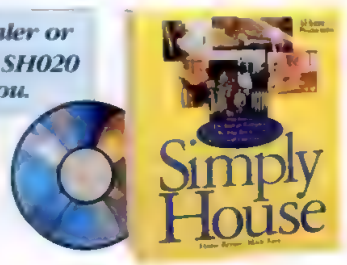

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CIRCLE 216 ON READER SERVICE CARD

Kids

Movies Meet The Classics On CD-ROM

The Secret Garden Interactive MovieBook

Sound Source Interactive, 800-877-4778, 805-494-9996.

Circle 489 on reader service card

★★★ WIN $29.95

Electronic books are nothing new, but Sound Source has taken the concept one step further with The Secret Garden Interactive MovieBook. Based on Frances Hodgson Burnett's classic children's tale, this charming interactive incarnation of The Secret Garden captures the imagination with its simple-to-navigate interface and stunning content.

This CD-ROM combines video, photos, music, and sound effects from the 1993 Warner Brothers film adaptation with the text from Scholastic's edition of the book based on the movie. All these elements are tied together in an intuitive manner that maximizes the potential for interactivity without distracting from the enchanting nature of the story.

Video clips and well-timed sound effects distinguish The Secret Garden Interactive MovieBook.

It is attention to detail that really distinguishes The Secret Garden. When the program is loaded, the cursor becomes an old-fashioned skeleton key (like the one that unlocks the secret garden discovered by the heroine). Usually thought to be a story for girls, the interactive version of the tale is not gender-specific: You choose whether to have a boy or girl narrate the text; you can enable or disable the read-to-me mode at any time. You also have the option to read the story from start to finish or jump to any of the 12 chapters. Of course, you can leave a bookmark behind when you exit the program.

Illustrations take the shape of full-motion video clips (which hide behind red curtains) and still images from the movie. Scattered throughout the easy-to-read text are objects that, when clicked on, launch animations relevant to the narrative, like the sound and motion of stomping feet or a map showing facts about India. Clicking on a word in boldface, meanwhile, produces the word's definition.

Aimed primarily at children aged three and older, The Secret Garden is a volume that even parents can appreciate. Plus, as with any favorite story, there is tremendous potential here for repeat reading (or viewing).

—Melissa J. Perenson

MOVING?

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History

Travel to the Past

Microsoft Ancient Lands

Microsoft Corp., 800-426-9400.
Circle 488 on reader service card
★★★ WIN $50.95

Don't come to Ancient Lands expecting Encarta, much less the British Museum. The emphasis here is on building a youngster's interest in the distant past. As such, Ancient Lands doesn't provide long articles, but it does offer a large number of interesting historical subjects accompanied by narration, animation, photographs, and video clips.

Take a living trip into civilizations past with Microsoft Ancient Lands.

You can access all this information from a map or an index or by choosing major subject categories. The most exciting way for kids to use Ancient Lands, though, is through the Guides. These are 18 "people" from different walks of life in Egypt, Greece, and other ancient lands. The Egyptian guides include a craftsman, a priestess, and an embalmer's daughter; the Greeks supply, among others, a bard, an actor, and a goddess from the Greek pantheon. These narrators provide an entertaining dose of conversation as they move through a variety of subjects.

Short shrift is paid to other cultures, however; some receive only a single screen, while others are totally omitted. For this reason, Ancient Lands shouldn't be purchased as a substitute for that trip to the museum, but as a way of getting kids primed to go there.

—Barry Brenesal

QUICK CLIPS

Recommended · It's Your Call · Not Recommended

? The Complete After Dark Collection

More flying toasters than anyone really needs. If you don't have the original, or you're a screen-saver junkie, try this CD-ROM; otherwise, save the hard disk space. *$39.99; Berkeley Systems Inc., 510-540-5535.*

The King's Quest Collection

It's hard to believe that PC games have existed long enough to have a history, but they have, and this is it for adventure fans. Every Quest from the beginning of time on one CD-ROM. *$59.95; Sierra On-Line, 800-757-7707.*

Learn to Do Word Processing with Benjamin Franklin

If you can't figure out word processing on your own, how much help can you expect from a guy who died before the computer was born? Forget this CD-ROM; go fly a kite instead. *$59.95; Allegro New Media, 800-424-1992.*

? Rapunzel

A homespun retelling of the classic tale that's rather sweet but nowhere near as sophisticated as the average electronic storybook. *$49.95; Boraventures Publishing, 800-648-9009.*

SPOTLIGHT ON COMEDY

Monty Python's Complete Waste of Time

Never has a product been as utterly misnamed as this hysterical CD-ROM thingy. This may be the 25th anniversary of Monty Python's Flying Circus, but the humor is as fresh as ever in this unique presentation that's part adventure game, part arcade game, and part video comedy show.

Explore the zany world of Monty Python's Flying Circus.

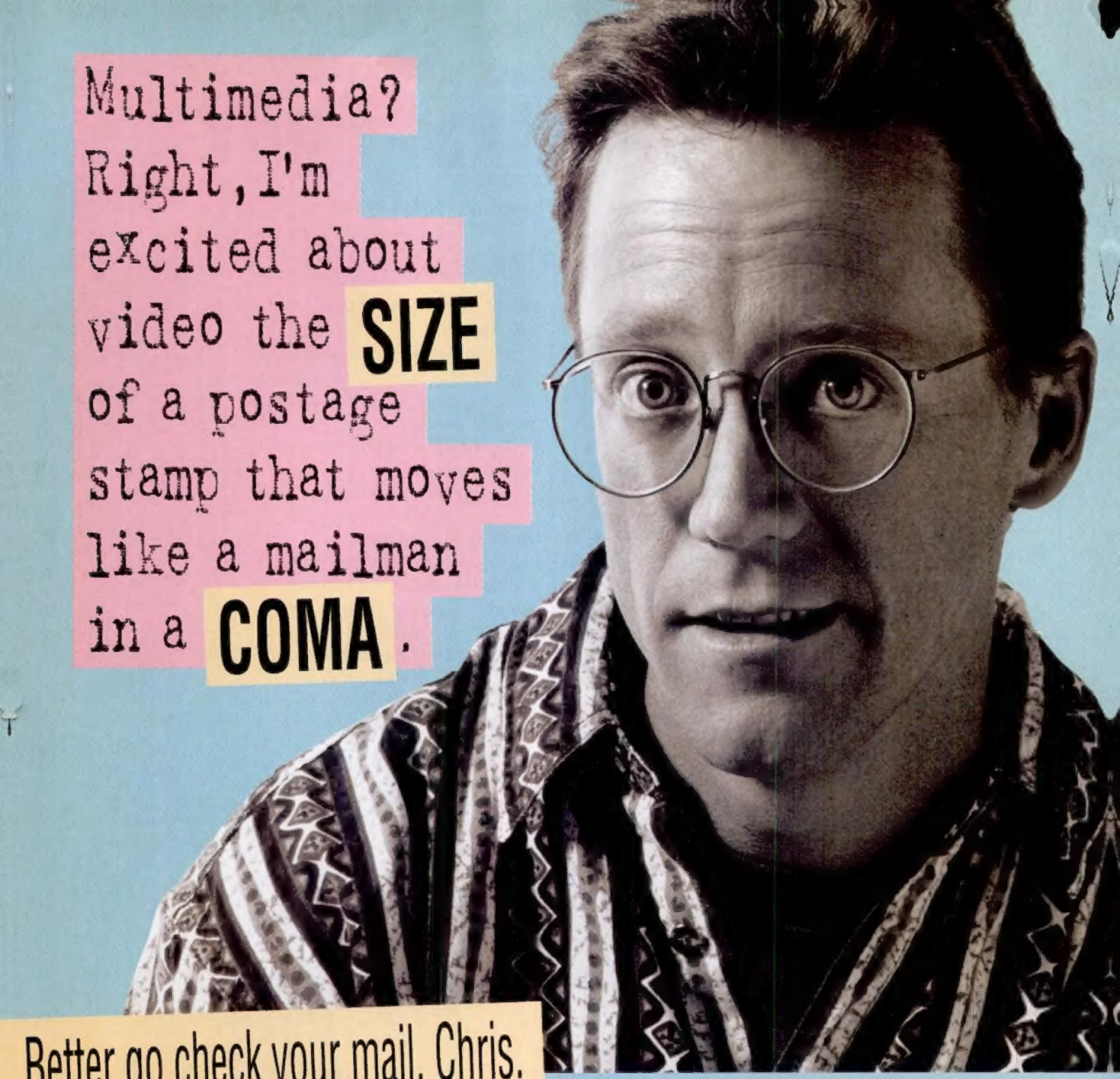
Of course, this is a special type of humor, one that's not intended for the faint of heart. The disk is just full of perverse, but ever so entertaining, activities such as arcade games that call for you to whack a gopher on the head or shoot down a flatulent chicken. But that's just the beginning. There are more than 30 video sketches here just waiting to be uncovered. These include Python classics such as "The Dead Parrot," "The Cheese Shop," "The Lumberjack Song," and of course, "Spam."

Much of the disk operates on the same principle as an electronic storybook: Click anywhere on the screen and watch what happens. Animated characters are liable to pop up from nowhere and break into song, or bare-bottomed women may dance the can-can. While you could just sit back and watch the merriment, your goal is to find clues and hints to help you unravel the secret to Intergalactic Success and possibly win yourself a Pentium-based multimedia PC.

If that's not incentive enough to take a look at this disk, consider the fun you could have with The Desktop Pythonizer. This Windows customization utility, which is also sold separately, serves up a series of animated screen savers and wallpapers, rude sound effects, and bits of dialog to attach to system events. Clearly, this is something completely different.

—Gayle C. Ehrenman

7th Level, 214-437-4858.
Circle 494 on reader service card
★★★★ WIN $49.95



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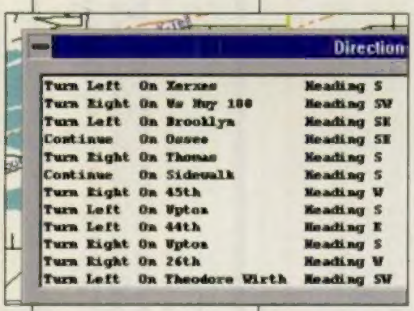

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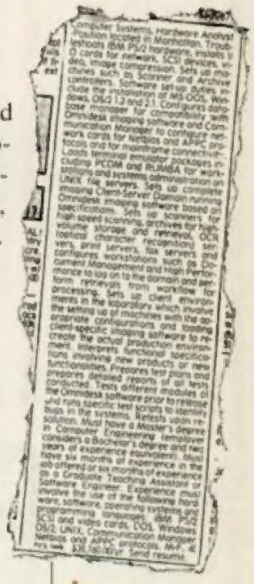

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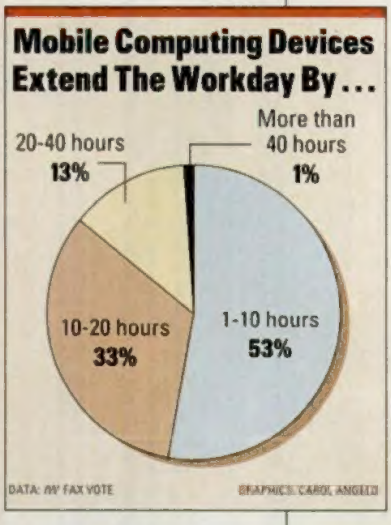
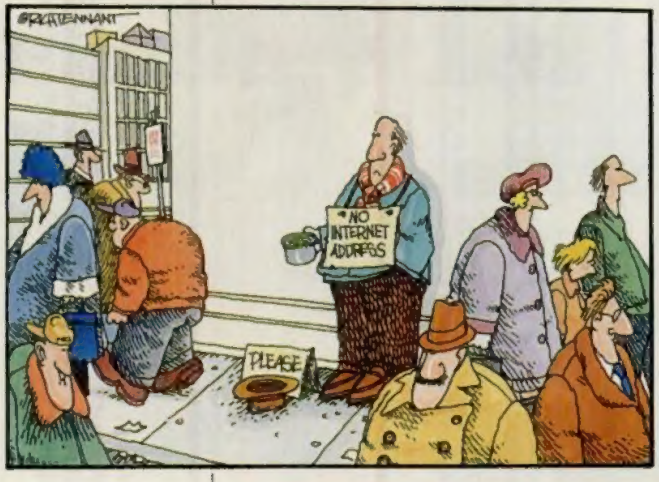


No wonder you're exhausted! (*Information Week.*)



Richard Tennant

"Click. Hello? Click. Hello?? Click. Hello???" (Personal Computing Tools catalog.)

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–*PC Computing*, December 1994

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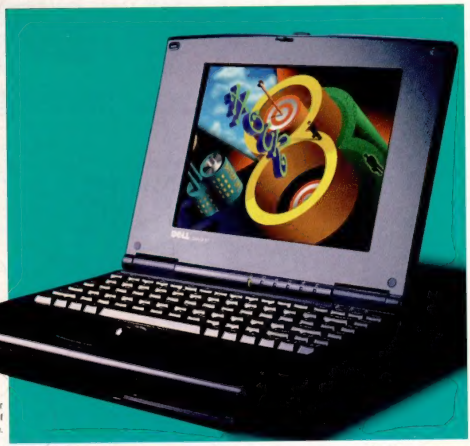
–*Mobile Office*, October 1994

"We'd be hard-pressed not to love the Latitude XP. Its myriad features were well-chosen and designed for the serious laptop user, and its power management system and battery life are second to none."
–*Laptop Buyers Guide*, September 1994



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